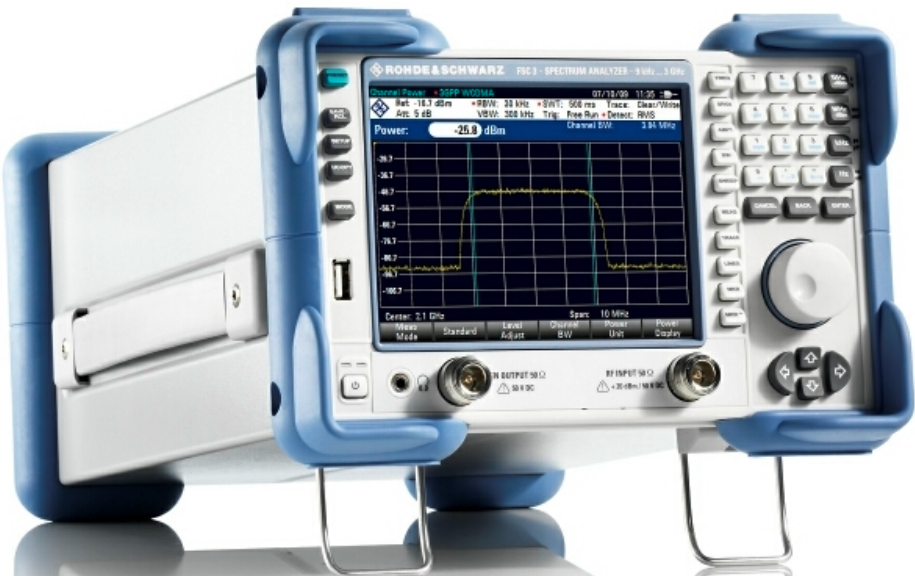# R&S®FSC
Spectrum Analyzer
Operating Manual

ROHDE&SCHWARZ

The Operating Manual describes the following models and options:

- R&S® FSC3 (1314.3006K03)
- R&S® FSC6 (1314.3006K06)
- R&S® FSC13 (1314.3006K13)
- R&S® FSC16 (1314.3006K16)

The following abbreviations are used throughout this manual:

R&S®FSC is abbreviated as R&S FSC

R&S®FSCView is abbreviated as R&SFSCView

Basic Safety Instructions

Always read through and comply with the following safety instructions!

All plants and locations of the Rohde & Schwarz group of companies make every effort to keep the safety standards of our products up to date and to offer our customers the highest possible degree of safety. Our products and the auxiliary equipment they require are designed, built and tested in accordance with the safety standards that apply in each case. Compliance with these standards is continuously monitored by our quality assurance system. The product described here has been designed, built and tested in accordance with the attached EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards. To maintain this condition and to ensure safe operation, you must observe all instructions and warnings provided in this manual. If you have any questions regarding these safety instructions, the Rohde & Schwarz group of companies will be happy to answer them.

Furthermore, it is your responsibility to use the product in an appropriate manner. This product is designed for use solely in industrial and laboratory environments or, if expressly permitted, also in the field and must not be used in any way that may cause personal injury or property damage. You are responsible if the product is used for any intention other than its designated purpose or in disregard of the manufacturer's instructions. The manufacturer shall assume no responsibility for such use of the product.

The product is used for its designated purpose if it is used in accordance with its product documentation and within its performance limits (see data sheet, documentation, the following safety instructions). Using the product requires technical skills and a basic knowledge of English. It is therefore essential that only skilled and specialized staff or thoroughly trained personnel with the required skills be allowed to use the product. If personal safety gear is required for using Rohde & Schwarz products, this will be indicated at the appropriate place in the product documentation. Keep the basic safety instructions and the product documentation in a safe place and pass them on to the subsequent users.

Observing the safety instructions will help prevent personal injury or damage of any kind caused by dangerous situations. Therefore, carefully read through and adhere to the following safety instructions before and when using the product. It is also absolutely essential to observe the additional safety instructions on personal safety, for example, that appear in relevant parts of the product documentation. In these safety instructions, the word "product" refers to all merchandise sold and distributed by the Rohde & Schwarz group of companies, including instruments, systems and all accessories.

Symbols and safety labels

Notice, general danger location Observe product documentation	Caution when handling heavy equipment	Danger of electric shock	Warning! Hot surface	PE terminal	Ground	Ground terminal	Be careful when handling electrostatic sensitive devices

ON/OFF supply voltage	Standby indication	Direct current (DC)	Alternating current (AC)	Direct/alternating current (DC/AC)	Device fully protected by double (reinforced) insulation

Tags and their meaning

The following signal words are used in the product documentation in order to warn the reader about risks and dangers.

⚠ **DANGER**	indicates a hazardous situation which, if not avoided, will result in death or serious injury.
⚠ **WARNING**	indicates a hazardous situation which, if not avoided, could result in death or serious injury.
⚠ **CAUTION**	indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	indicates the possibility of incorrect operation which can result in damage to the product. In the product documentation, the word ATTENTION is used synonymously.

These tags are in accordance with the standard definition for civil applications in the European Economic Area. Definitions that deviate from the standard definition may also exist in other economic areas or military applications. It is therefore essential to make sure that the tags described here are always used only in connection with the related product documentation and the related product. The use of tags in connection with unrelated products or documentation can result in misinterpretation and in personal injury or material damage.

Operating states and operating positions

The product may be operated only under the operating conditions and in the positions specified by the manufacturer, without the product's ventilation being obstructed. If the manufacturer's specifications are not observed, this can result in electric shock, fire and/or serious personal injury or death. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed.

1. Unless otherwise specified, the following requirements apply to Rohde & Schwarz products: predefined operating position is always with the housing floor facing down, IP protection 2X, pollution severity 2, overvoltage category 2, use only indoors, max. operating altitude 2000 m above sea level, max. transport altitude 4500 m above sea level. A tolerance of ±10 % shall apply to the nominal voltage and ±5 % to the nominal frequency.

2. Do not place the product on surfaces, vehicles, cabinets or tables that for reasons of weight or stability are unsuitable for this purpose. Always follow the manufacturer's installation instructions when installing the product and fastening it to objects or structures (e.g. walls and shelves). An installation that is not carried out as described in the product documentation could result in personal injury or death.

3. Do not place the product on heat-generating devices such as radiators or fan heaters. The ambient temperature must not exceed the maximum temperature specified in the product documentation or in the data sheet. Product overheating can cause electric shock, fire and/or serious personal injury or death.

Electrical safety

If the information on electrical safety is not observed either at all to the extent necessary, electric shock, fire and/or serious personal injury or death may occur.

1. Prior to switching on the product, always ensure that the nominal voltage setting on the product matches the nominal voltage of the AC supply network. If a different voltage is to be set, the power fuse of the product may have to be changed accordingly.

2. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with an earthing contact and protective earth connection.

3. Intentionally breaking the protective earth connection either in the feed line or in the product itself is not permitted. Doing so can result in the danger of an electric shock from the product. If extension cords or connector strips are implemented, they must be checked on a regular basis to ensure that they are safe to use.

4. If the product does not have a power switch for disconnection from the AC supply network, the plug of the connecting cable is regarded as the disconnecting device. In such cases, always ensure that the power plug is easily reachable and accessible at all times (corresponding to the length of connecting cable, approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply network. If products without power switches are integrated into racks or systems, a disconnecting device must be provided at the system level.

5. Never use the product if the power cable is damaged. Check the power cable on a regular basis to ensure that it is in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, you can ensure that the cable will not be damaged and that no one can be hurt by, for example, tripping over the cable or suffering an electric shock.

6. The product may be operated only from TN/TT supply networks fused with max. 16 A (higher fuse only after consulting with the Rohde & Schwarz group of companies).

7. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket. Otherwise, sparks that result in fire and/or injuries may occur.

8. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.

9. For measurements in circuits with voltages V_{rms} > 30 V, suitable measures (e.g. appropriate measuring equipment, fusing, current limiting, electrical separation, insulation) should be taken to avoid any hazards.

10. Ensure that the connections with information technology equipment, e.g. PCs or other industrial computers, comply with the IEC60950-1/EN60950-1 or IEC61010-1/EN 61010-1 standards that apply in each case.

11. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.

12. If a product is to be permanently installed, the connection between the PE terminal on site and the product's PE conductor must be made first before any other connection is made. The product may be installed and connected only by a licensed electrician.

13. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused in such a way that anyone who has access to the product, as well as the product itself, is adequately protected from injury or damage.

14. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the person operating the product will be exposed to the danger of an electric shock.

15. Any object that is not designed to be placed in the openings of the housing must not be used for this purpose. Doing so can cause short circuits inside the product and/or electric shocks, fire or injuries.

16. Unless specified otherwise, products are not liquid-proof (see also section "Operating states and operating positions", item 1. Therefore, the equipment must be protected against penetration by liquids. If the necessary precautions are not taken, the user may suffer electric shock or the product itself may be damaged, which can also lead to personal injury.

17. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product has been moved from a cold to a warm environment. Penetration by water increases the risk of electric shock.

18. Prior to cleaning the product, disconnect it completely from the power supply (e.g. AC supply network or battery). Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol, acetone or diluents for cellulose lacquers.

Operation

1. Operating the products requires special training and intense concentration. Make sure that persons who use the products are physically, mentally and emotionally fit enough to do so; otherwise, injuries or material damage may occur. It is the responsibility of the employer/operator to select suitable personnel for operating the products.

2. Before you move or transport the product, read and observe the section titled "Transport".

3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens) such as nickel cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties) when using a Rohde & Schwarz product, consult a physician immediately to determine the cause and to prevent health problems or stress.

4. Before you start processing the product mechanically and/or thermally, or before you take it apart, be sure to read and pay special attention to the section titled "Waste disposal", item 1.

5. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn babies require increased protection, pregnant women must be protected by appropriate measures. Persons with pacemakers may also be exposed to risks from electromagnetic radiation. The employer/operator must evaluate workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the potential danger.

6. Should a fire occur, the product may release hazardous substances (gases, fluids, etc.) that can cause health problems. Therefore, suitable measures must be taken, e.g. protective masks and protective clothing must be worn.

7. If a laser product (e.g. a CD/DVD drive) is integrated into a Rohde & Schwarz product, absolutely no other settings or functions may be used as described in the product documentation. The objective is to prevent personal injury (e.g. due to laser beams).

Repair and service

1. The product may be opened only by authorized, specially trained personnel. Before any work is performed on the product or before the product is opened, it must be disconnected from the AC supply network. Otherwise, personnel will be exposed to the risk of an electric shock.

2. Adjustments, replacement of parts, maintenance and repair may be performed only by electrical experts authorized by Rohde & Schwarz. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, PE conductor test, insulation resistance measurement, leakage current measurement, functional test). This helps ensure the continued safety of the product.

Batteries and rechargeable batteries/cells

If the information regarding batteries and rechargeable batteries/cells is not observed either at all or to the extent necessary, product users may be exposed to the risk of explosions, fire and/or serious personal injury, and, in some cases, death. Batteries and rechargeable batteries with alkaline electrolytes (e.g. lithium cells) must be handled in accordance with the EN 62133 standard.

1. Cells must not be taken apart or crushed.

2. Cells or batteries must not be exposed to heat or fire. Storage in direct sunlight must be avoided. Keep cells and batteries clean and dry. Clean soiled connectors using a dry, clean cloth.

3. Cells or batteries must not be short-circuited. Cells or batteries must not be stored in a box or in a drawer where they can short-circuit each other, or where they can be short-circuited by other conductive materials. Cells and batteries must not be removed from their original packaging until they are ready to be used.

4. Keep cells and batteries out of the hands of children. If a cell or a battery has been swallowed, seek medical aid immediately.

5. Cells and batteries must not be exposed to any mechanical shocks that are stronger than permitted.

6. If a cell develops a leak, the fluid must not be allowed to come into contact with the skin or eyes. If contact occurs, wash the affected area with plenty of water and seek medical aid.

7. Improperly replacing or charging cells or batteries that contain alkaline electrolytes (e.g. lithium cells) can cause explosions. Replace cells or batteries only with the matching Rohde & Schwarz type (see parts list) in order to ensure the safety of the product.

8. Cells and batteries must be recycled and kept separate from residual waste. Rechargeable batteries and normal batteries that contain lead, mercury or cadmium are hazardous waste. Observe the national regulations regarding waste disposal and recycling.

Transport

1. The product may be very heavy. Therefore, the product must be handled with care. In some cases, the user may require a suitable means of lifting or moving the product (e.g. with a lift-truck) to avoid back or other physical injuries.

2. Handles on the products are designed exclusively to enable personnel to transport the product. It is therefore not permissible to use handles to fasten the product to or on transport equipment such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport or lifting. Observe the safety regulations of the manufacturer of the means of transport or lifting. Noncompliance can result in personal injury or material damage.

3. If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely and properly. The manufacturer assumes no responsibility for accidents or collisions. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident.

Waste disposal

1. If products or their components are mechanically and/or thermally processed in a manner that goes beyond their intended use, hazardous substances (heavy-metal dust such as lead, beryllium, nickel) may be released. For this reason, the product may only be disassembled by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.

2. If handling the product releases hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation. The improper disposal of hazardous substances or fuels can cause health problems and lead to environmental damage.

Informaciones elementales de seguridad

Es imprescindible leer y observar las siguientes instrucciones e informaciones de seguridad!

El principio del grupo de empresas Rohde & Schwarz consiste en tener nuestros productos siempre al día con los estándares de seguridad y de ofrecer a nuestros clientes el máximo grado de seguridad. Nuestros productos y todos los equipos adicionales son siempre fabricados y examinados según las normas de seguridad vigentes. Nuestro sistema de garantía de calidad controla constantemente que sean cumplidas estas normas. El presente producto ha sido fabricado y examinado según el certificado de conformidad adjunto de la UE y ha salido de nuestra planta en estado impecable según los estándares técnicos de seguridad. Para poder preservar este estado y garantizar un funcionamiento libre de peligros, el usuario deberá atenerse a todas las indicaciones, informaciones de seguridad y notas de alerta. El grupo de empresas Rohde & Schwarz está siempre a su disposición en caso de que tengan preguntas referentes a estas informaciones de seguridad.

Además queda en la responsabilidad del usuario utilizar el producto en la forma debida. Este producto está destinado exclusivamente al uso en la industria y el laboratorio o, si ha sido expresamente autorizado, para aplicaciones de campo y de ninguna manera deberá ser utilizado de modo que alguna persona/cosa pueda sufrir daño. El uso del producto fuera de sus fines definidos o sin tener en cuenta las instrucciones del fabricante queda en la responsabilidad del usuario. El fabricante no se hace en ninguna forma responsable de consecuencias a causa del mal uso del producto.

Se parte del uso correcto del producto para los fines definidos si el producto es utilizado conforme a las indicaciones de la correspondiente documentación del producto y dentro del margen de rendimiento definido (ver hoja de datos, documentación, informaciones de seguridad que siguen). El uso del producto hace necesarios conocimientos técnicos y ciertos conocimientos del idioma inglés. Por eso se debe tener en cuenta que el producto solo pueda ser operado por personal especializado o personas instruidas en profundidad con las capacidades correspondientes. Si fuera necesaria indumentaria de seguridad para el uso de productos de Rohde & Schwarz, encontraría la información debida en la documentación del producto en el capítulo correspondiente. Guarde bien las informaciones de seguridad elementales, así como la documentación del producto, y entréguelas a usuarios posteriores.

Tener en cuenta las informaciones de seguridad sirve para evitar en lo posible lesiones o daños por peligros de toda clase. Por eso es imprescindible leer detalladamente y comprender por completo las siguientes informaciones de seguridad antes de usar el producto, y respetarlas durante el uso del producto. Deberán tenerse en cuenta todas las demás informaciones de seguridad, como p. ej. las referentes a la protección de personas, que encontrarán en el capítulo correspondiente de la documentación del producto y que también son de obligado cumplimiento. En las presentes informaciones de seguridad se recogen todos los objetos que distribuye el grupo de empresas Rohde & Schwarz bajo la denominación de "producto", entre ellos también aparatos, instalaciones así como toda clase de accesorios.

Símbolos y definiciones de seguridad

Aviso: punto de peligro general Observar la documentación del producto	Atención en el manejo de dispositivos de peso elevado	Peligro de choque eléctrico	Adver-tencia: superficie caliente	Conexión a conductor de protección	Conexión a tierra	Conexión a masa	Aviso: Cuidado en el manejo de dispositivos sensibles a la electrostática (ESD)

Tensión de alimentación de PUESTA EN MARCHA / PARADA	Indicación de estado de espera (Standby)	Corriente continua (DC)	Corriente alterna (AC)	Corriente continua / Corriente alterna (DC/AC)	El aparato está protegido en su totalidad por un aislamiento doble (reforzado)

Palabras de señal y su significado

En la documentación del producto se utilizan las siguientes palabras de señal con el fin de advertir contra riesgos y peligros.

> ⚠ **PELIGRO**

PELIGRO identifica un peligro inminente con riesgo elevado que provocará muerte o lesiones graves si no se evita.

> ⚠ **ADVERTENCIA**

ADVERTENCIA identifica un posible peligro con riesgo medio de provocar muerte o lesiones (graves) si no se evita.

> ⚠ **ATENCIÓN**

ATENCIÓN identifica un peligro con riesgo reducido de provocar lesiones leves o moderadas si no se evita.

> *AVISO*

AVISO indica la posibilidad de utilizar mal el producto y, como consecuencia, dañarlo.
En la documentación del producto se emplea de forma sinónima el término CUIDADO.

Las palabras de señal corresponden a la definición habitual para aplicaciones civiles en el área económica europea. Pueden existir definiciones diferentes a esta definición en otras áreas económicas o en aplicaciones militares. Por eso se deberá tener en cuenta que las palabras de señal aquí descritas sean utilizadas siempre solamente en combinación con la correspondiente documentación del producto y solamente en combinación con el producto correspondiente. La utilización de las palabras de señal en combinación con productos o documentaciones que no les correspondan puede llevar a interpretaciones equivocadas y tener por consecuencia daños en personas u objetos.

Estados operativos y posiciones de funcionamiento

El producto solamente debe ser utilizado según lo indicado por el fabricante respecto a los estados operativos y posiciones de funcionamiento sin que se obstruya la ventilación. Si no se siguen las indicaciones del fabricante, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte. En todos los trabajos deberán ser tenidas en cuenta las normas nacionales y locales de seguridad del trabajo y de prevención de accidentes.

1. Si no se convino de otra manera, es para los productos Rohde & Schwarz válido lo que sigue: como posición de funcionamiento se define por principio la posición con el suelo de la caja para abajo, modo de protección IP 2X, grado de suciedad 2, categoría de sobrecarga eléctrica 2, uso solamente en estancias interiores, utilización hasta 2000 m sobre el nivel del mar, transporte hasta 4500 m sobre el nivel del mar. Se aplicará una tolerancia de ±10 % sobre el voltaje nominal y de ±5 % sobre la frecuencia nominal.

2. No sitúe el producto encima de superficies, vehículos, estantes o mesas, que por sus características de peso o de estabilidad no sean aptos para él. Siga siempre las instrucciones de instalación del fabricante cuando instale y asegure el producto en objetos o estructuras (p. ej. paredes y estantes). Si se realiza la instalación de modo distinto al indicado en la documentación del producto, pueden causarse lesiones o incluso la muerte.

3. No ponga el producto sobre aparatos que generen calor (p. ej. radiadores o calefactores). La temperatura ambiente no debe superar la temperatura máxima especificada en la documentación del producto o en la hoja de datos. En caso de sobrecalentamiento del producto, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte.

Seguridad eléctrica

Si no se siguen (o se siguen de modo insuficiente) las indicaciones del fabricante en cuanto a seguridad eléctrica, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte.

1. Antes de la puesta en marcha del producto se deberá comprobar siempre que la tensión preseleccionada en el producto coincida con la de la red de alimentación eléctrica. Si es necesario modificar el ajuste de tensión, también se deberán cambiar en caso dado los fusibles correspondientes del producto.

2. Los productos de la clase de protección I con alimentación móvil y enchufe individual solamente podrán enchufarse a tomas de corriente con contacto de seguridad y con conductor de protección conectado.

3. Queda prohibida la interrupción intencionada del conductor de protección, tanto en la toma de corriente como en el mismo producto. La interrupción puede tener como consecuencia el riesgo de que el producto sea fuente de choques eléctricos. Si se utilizan cables alargadores o regletas de enchufe, deberá garantizarse la realización de un examen regular de los mismos en cuanto a su estado técnico de seguridad.

4. Si el producto no está equipado con un interruptor para desconectarlo de la red, se deberá considerar el enchufe del cable de conexión como interruptor. En estos casos se deberá asegurar que el enchufe siempre sea de fácil acceso (de acuerdo con la longitud del cable de conexión, aproximadamente 2 m). Los interruptores de función o electrónicos no son aptos para el corte de la red eléctrica. Si los productos sin interruptor están integrados en bastidores o instalaciones, se deberá colocar el interruptor en el nivel de la instalación.

5. No utilice nunca el producto si está dañado el cable de conexión a red. Compruebe regularmente el correcto estado de los cables de conexión a red. Asegúrese, mediante las medidas de protección y de instalación adecuadas, de que el cable de conexión a red no pueda ser dañado o de que nadie pueda ser dañado por él, p. ej. al tropezar o por un choque eléctrico.

6. Solamente está permitido el funcionamiento en redes de alimentación TN/TT aseguradas con fusibles de 16 A como máximo (utilización de fusibles de mayor amperaje solo previa consulta con el grupo de empresas Rohde & Schwarz).

7. Nunca conecte el enchufe en tomas de corriente sucias o llenas de polvo. Introduzca el enchufe por completo y fuertemente en la toma de corriente. La no observación de estas medidas puede provocar chispas, fuego y/o lesiones.

8. No sobrecargue las tomas de corriente, los cables alargadores o las regletas de enchufe ya que esto podría causar fuego o choques eléctricos.

9. En las mediciones en circuitos de corriente con una tensión $U_{eff} > 30$ V se deberán tomar las medidas apropiadas para impedir cualquier peligro (p. ej. medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).

10. Para la conexión con dispositivos informáticos como un PC o un ordenador industrial, debe comprobarse que éstos cumplan los estándares IEC60950-1/EN60950-1 o IEC61010-1/EN 61010-1 válidos en cada caso.

11. A menos que esté permitido expresamente, no retire nunca la tapa ni componentes de la carcasa mientras el producto esté en servicio. Esto pone a descubierto los cables y componentes eléctricos y puede causar lesiones, fuego o daños en el producto.

12. Si un producto se instala en un lugar fijo, se deberá primero conectar el conductor de protección fijo con el conductor de protección del producto antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efectuadas por un electricista especializado.

13. En el caso de dispositivos fijos que no estén provistos de fusibles, interruptor automático ni otros mecanismos de seguridad similares, el circuito de alimentación debe estar protegido de modo que todas las personas que puedan acceder al producto, así como el producto mismo, estén a salvo de posibles daños.

14. Todo producto debe estar protegido contra sobretensión (debida p. ej. a una caída del rayo) mediante los correspondientes sistemas de protección. Si no, el personal que lo utilice quedará expuesto al peligro de choque eléctrico.

15. No debe introducirse en los orificios de la caja del aparato ningún objeto que no esté destinado a ello. Esto puede producir cortocircuitos en el producto y/o puede causar choques eléctricos, fuego o lesiones.

16. Salvo indicación contraria, los productos no están impermeabilizados (ver también el capítulo "Estados operativos y posiciones de funcionamiento", punto 1). Por eso es necesario tomar las medidas necesarias para evitar la entrada de líquidos. En caso contrario, existe peligro de choque eléctrico para el usuario o de daños en el producto, que también pueden redundar en peligro para las personas.

17. No utilice el producto en condiciones en las que pueda producirse o ya se hayan producido condensaciones sobre el producto o en el interior de éste, como p. ej. al desplazarlo de un lugar frío a otro caliente. La entrada de agua aumenta el riesgo de choque eléctrico.

18. Antes de la limpieza, desconecte por completo el producto de la alimentación de tensión (p. ej. red de alimentación o batería). Realice la limpieza de los aparatos con un paño suave, que no se deshilache. No utilice bajo ningún concepto productos de limpieza químicos como alcohol, acetona o diluyentes para lacas nitrocelulósicas.

Funcionamiento

1. El uso del producto requiere instrucciones especiales y una alta concentración durante el manejo. Debe asegurarse que las personas que manejen el producto estén a la altura de los requerimientos necesarios en cuanto a aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario u operador es responsable de seleccionar el personal usuario apto para el manejo del producto.

2. Antes de desplazar o transportar el producto, lea y tenga en cuenta el capítulo "Transporte".

3. Como con todo producto de fabricación industrial no puede quedar excluida en general la posibilidad de que se produzcan alergias provocadas por algunos materiales empleados, los llamados alérgenos (p. ej. el níquel). Si durante el manejo de productos Rohde & Schwarz se producen reacciones alérgicas, como p. ej. irritaciones cutáneas, estornudos continuos, enrojecimiento de la conjuntiva o dificultades respiratorias, debe avisarse inmediatamente a un médico para investigar las causas y evitar cualquier molestia o daño a la salud.

4. Antes de la manipulación mecánica y/o térmica o el desmontaje del producto, debe tenerse en cuenta imprescindiblemente el capítulo "Eliminación", punto 1.

5. Ciertos productos, como p. ej. las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. Deben tomarse todas las medidas necesarias para la protección de las mujeres embarazadas. También las personas con marcapasos pueden correr peligro a causa de la radiación electromagnética. El empresario/operador tiene la obligación de evaluar y señalizar las áreas de trabajo en las que exista un riesgo elevado de exposición a radiaciones.

6. Tenga en cuenta que en caso de incendio pueden desprenderse del producto sustancias tóxicas (gases, líquidos etc.) que pueden generar daños a la salud. Por eso, en caso de incendio deben usarse medidas adecuadas, como p. ej. máscaras antigás e indumentaria de protección.

7. En caso de que un producto Rohde & Schwarz contenga un producto láser (p. ej. un lector de CD/DVD), no debe usarse ninguna otra configuración o función aparte de las descritas en la documentación del producto, a fin de evitar lesiones (p. ej. debidas a irradiación láser).

Reparación y mantenimiento

1. El producto solamente debe ser abierto por personal especializado con autorización para ello. Antes de manipular el producto o abrirlo, es obligatorio desconectarlo de la tensión de alimentación, para evitar toda posibilidad de choque eléctrico.

2. El ajuste, el cambio de partes, el mantenimiento y la reparación deberán ser efectuadas solamente por electricistas autorizados por Rohde & Schwarz. Si se reponen partes con importancia para los aspectos de seguridad (p. ej. el enchufe, los transformadores o los fusibles), solamente podrán ser sustituidos por partes originales. Después de cada cambio de partes relevantes para la seguridad deberá realizarse un control de seguridad (control a primera vista, control del conductor de protección, medición de resistencia de aislamiento, medición de la corriente de fuga, control de funcionamiento). Con esto queda garantizada la seguridad del producto.

Baterías y acumuladores o celdas

Si no se siguen (o se siguen de modo insuficiente) las indicaciones en cuanto a las baterías y acumuladores o celdas, pueden producirse explosiones, incendios y/o lesiones graves con posible consecuencia de muerte. El manejo de baterías y acumuladores con electrolitos alcalinos (p. ej. celdas de litio) debe seguir el estándar EN 62133.

1. No deben desmontarse, abrirse ni triturarse las celdas.

2. Las celdas o baterías no deben someterse a calor ni fuego. Debe evitarse el almacenamiento a la luz directa del sol. Las celdas y baterías deben mantenerse limpias y secas. Limpiar las conexiones sucias con un paño seco y limpio.

3. Las celdas o baterías no deben cortocircuitarse. Es peligroso almacenar las celdas o baterías en estuches o cajones en cuyo interior puedan cortocircuitarse por contacto recíproco o por contacto con otros materiales conductores. No deben extraerse las celdas o baterías de sus embalajes originales hasta el momento en que vayan a utilizarse.

4. Mantener baterías y celdas fuera del alcance de los niños. En caso de ingestión de una celda o batería, avisar inmediatamente a un médico.

5. Las celdas o baterías no deben someterse a impactos mecánicos fuertes indebidos.

6. En caso de falta de estanqueidad de una celda, el líquido vertido no debe entrar en contacto con la piel ni los ojos. Si se produce contacto, lavar con agua abundante la zona afectada y avisar a un médico.

7. En caso de cambio o recarga inadecuados, las celdas o baterías que contienen electrolitos alcalinos (p. ej. las celdas de litio) pueden explotar. Para garantizar la seguridad del producto, las celdas o baterías solo deben ser sustituidas por el tipo Rohde & Schwarz correspondiente (ver lista de recambios).

8. Las baterías y celdas deben reciclarse y no deben tirarse a la basura doméstica. Las baterías o acumuladores que contienen plomo, mercurio o cadmio deben tratarse como residuos especiales. Respete en esta relación las normas nacionales de eliminación y reciclaje.

Transporte

1. El producto puede tener un peso elevado. Por eso es necesario desplazarlo o transportarlo con precaución y, si es necesario, usando un sistema de elevación adecuado (p. ej. una carretilla elevadora), a fin de evitar lesiones en la espalda u otros daños personales.

2. Las asas instaladas en los productos sirven solamente de ayuda para el transporte del producto por personas. Por eso no está permitido utilizar las asas para la sujeción en o sobre medios de transporte como p. ej. grúas, carretillas elevadoras de horquilla, carros etc. Es responsabilidad suya fijar los productos de manera segura a los medios de transporte o elevación. Para evitar daños personales o daños en el producto, siga las instrucciones de seguridad del fabricante del medio de transporte o elevación utilizado.

3. Si se utiliza el producto dentro de un vehículo, recae de manera exclusiva en el conductor la responsabilidad de conducir el vehículo de manera segura y adecuada. El fabricante no asumirá ninguna responsabilidad por accidentes o colisiones. No utilice nunca el producto dentro de un vehículo en movimiento si esto pudiera distraer al conductor. Asegure el producto dentro del vehículo debidamente para evitar, en caso de un accidente, lesiones u otra clase de daños.

Eliminación

1. Si se trabaja de manera mecánica y/o térmica cualquier producto o componente más allá del funcionamiento previsto, pueden liberarse sustancias peligrosas (polvos con contenido de metales pesados como p. ej. plomo, berilio o níquel). Por eso el producto solo debe ser desmontado por personal especializado con formación adecuada. Un desmontaje inadecuado puede ocasionar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes a la eliminación de residuos.

2. En caso de que durante el trato del producto se formen sustancias peligrosas o combustibles que deban tratarse como residuos especiales (p. ej. refrigerantes o aceites de motor con intervalos de cambio definidos), deben tenerse en cuenta las indicaciones de seguridad del fabricante de dichas sustancias y las normas regionales de eliminación de residuos. Tenga en cuenta también en caso necesario las indicaciones de seguridad especiales contenidas en la documentación del producto. La eliminación incorrecta de sustancias peligrosas o combustibles puede causar daños a la salud o daños al medio ambiente.

Kundeninformation zur Batterieverordnung (BattV)

Dieses Gerät enthält eine schadstoffhaltige Batterie. Diese darf nicht mit dem Hausmüll entsorgt werden.

Nach Ende der Lebensdauer darf die Entsorgung nur über eine Rohde&Schwarz-Kundendienststelle oder eine geeignete Sammelstelle erfolgen.

Safety Regulations for Batteries (according to BattV)

This equipment houses a battery containing harmful substances that must not be disposed of as normal household waste.

After its useful life, the battery may only be disposed of at a Rohde & Schwarz service center or at a suitable depot.
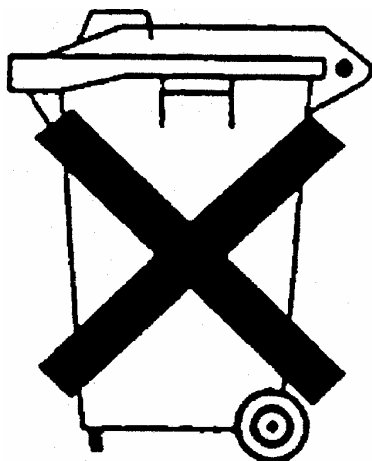
Normas de Seguridad para Baterías (Según BattV)

Este equipo lleva una batería que contiene sustancias perjudiciales, que no se debe desechar en los contenedores de basura domésticos.

Después de la vida útil, la batería sólo se podrá eliminar en un centro de servicio de Rohde & Schwarz o en un depósito apropiado.

Consignes de sécurité pour batteries (selon BattV)

Cet appareil est équipé d'une pile comprenant des substances nocives. Ne jamais la jeter dans une poubelle pour ordures ménagéres.

Une pile usagée doit uniquement être éliminée par un centre de service client de Rohde & Schwarz ou peut être collectée pour être traitée spécialement comme déchets dangereux.

Customer Information Regarding Product Disposal

The German Electrical and Electronic Equipment (ElektroG) Act is an implementation of the following EC directives:

- 2002/96/EC on waste electrical and electronic equipment (WEEE) and
- 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS).
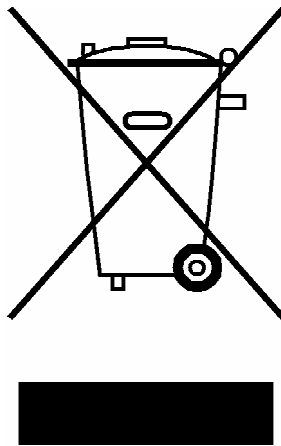
Product labeling in accordance with EN 50419

Once the lifetime of a product has ended, this product must not be disposed of in the standard domestic refuse. Even disposal via the municipal collection points for waste electrical and electronic equipment is not permitted.

Rohde & Schwarz GmbH & Co. KG has developed a disposal concept for the environmental-friendly disposal or recycling of waste material and fully assumes its obligation as a producer to take back and dispose of electrical and electronic waste in accordance with the ElektroG Act.

Please contact your local service representative to dispose of the product.

ROHDE & SCHWARZ

ROHDE&SCHWARZ

EC Certificate of Conformity

CE

Certificate No.: 2009-74

This is to certify that:

Equipment type	Stock No.	Designation
FSC	1314.3006.xx	SPECTRUM ANALYZER

complies with the provisions of the Directive of the Council of the European Union on the approximation of the laws of the Member States

- relating to electrical equipment for use within defined voltage limits (2006/95/EC)

- relating to electromagnetic compatibility (2004/108/EC)

Conformity is proven by compliance with the following standards:

EN 61326-1: 2006
EN 61326-2-1: 2006
EN 55011: 2007 + A2: 2007
EN 61000-3-2: 2006
EN 61000-3-3: 1995 + A1: 2001 + A2: 2005

For the assessment of electromagnetic compatibility, the limits of radio interference for Class A equipment as well as the immunity to interference for operation in industry have been used as a basis.

ROHDE & SCHWARZ GmbH & Co. KG
Mühldorfstr. 15, D-81671 München

Munich, 2009-12-18   Central Quality Management MF-QZ / Radde

Qualitätszertifikat
Certificate of quality
Certificat de qualité

Sehr geehrter Kunde,

Sie haben sich für den Kauf eines Rohde&Schwarz-Produktes entschieden. Hiermit erhalten Sie ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unseres Qualitätsmanagementsystems entwickelt, gefertigt und geprüft. Das Rohde&Schwarz-Qualitätsmanagementsystem ist u.a. nach ISO9001 und ISO14001 zertifiziert.

Der Umwelt verpflichtet
- Energie-effiziente, RoHS-konforme Produkte
- Kontinuierliche Weiterentwicklung nachhaltiger Umweltkonzepte
- ISO14001-zertifiziertes Umweltmanagementsystem

Dear Customer,

You have decided to buy a Rohde&Schwarz product. You are thus assured of receiving a product that is manufactured using the most modern methods available. This product was developed, manufactured and tested in compliance with our quality management system standards. The Rohde&Schwarz quality management system is certified according to standards such as ISO9001 and ISO14001.

Environmental commitment
- Energy-efficient products
- Continuous improvement in environmental sustainability
- ISO14001-certified environmental management system

Cher client,

Vous avez choisi d'acheter un produit Rohde&Schwarz. Vous disposez donc d'un produit fabriqué d'après les méthodes les plus avancées. Le développement, la fabrication et les tests respectent nos normes de gestion qualité. Le système de gestion qualité de Rohde&Schwarz a été homologué, entre autres, conformément aux normes ISO9001 et ISO14001.

Engagement écologique
- Produits à efficience énergétique
- Amélioration continue de la durabilité environnementale
- Système de gestion de l'environnement certifié selon ISO14001

75 Years of Driving Innovation

ROHDE&SCHWARZ

Contents

Safety Instructions
Customer Information Regarding Product Disposal
Safety Regulations for Batteries
Certificate of Quality
EC-Certificate of Conformity
Support Center Address

1 Putting into Operation

For details refer to the Quick Start Guide, chapter 1 "Putting into Operation" and chapter 2 "Preparing for Use".

2 Getting Started

For details refer to the Quick Start Guide, chapter 4 "Getting Started".

3 Operation

3.1   Screen Layout

1	Measurement information	8	Trace
2	Date and time	9	Horizontal axis labeling
3	Hardware settings	10	Reference Position
4	Marker information	11	Currently selected menu item
5	Status line	12	Active menu item
6	Invalid trace indicator	13	Selectable menu item
7	Marker	14	Vertical axis labeling
		15	Softkey menu

The color of the softkey labelling and its background indicate the status of the softkey function in question:

Softkey color	Meaning
Gray background, white labeling	Softkey function is turned off
Gray background, gray labeling	In the current setting, this softkey function is not available
Green background	Softkey function is turned on
Blue background	Softkey function has been activated for value entry or selecting a menu function

3.2 Entering Measurement Parameters

Settings and texts are entered either by directly calling the functions or by entering values, units or texts separately. The R&S FSC has a variety of operating modes.

① Alpha-numeric keypad
② Unit keys
③ ENTER Key
④ BACK Key
⑤ CANCEL Key
⑥ Rotary Knob
⑦ Cursor Keys

3.2.1 Entering values and texts

Values are entered using the number keys (0 to 9), the decimal point key (.) and the minus key (-) in the alphanumeric keypad. The alphanumeric keypad is also used to enter letters, e.g. file names for data sets. If the R&S FSC is expecting a letter entry, it automatically assigns the letters above the keys to the keys in the alphanumeric keypad. The keys have multiple assignments. The desired letter is obtained by pressing the key the appropriate number of times, similar to a mobile phone keypad. The key assignments are listed below:

Key	1.	2.	3.	4.	5.	6.	7.	8.	9.
1	p	q	r	s	1	P	Q	R	S
2	t	u	v	2	T	U	V		
3	w	x	y	z	3	W	X	Y	Z
4	g	h	i	4	G	H	I		
5	j	k	l	5	J	K	L		
6	m	n	O	6	M	N	O		
7	7								
8	a	b	c	8	A	B	C		
9	d	e	f	9	D	E	F		
-	-	a→A							
0	0	blank	_						
.	.								

You can delete any letter or digit you have entered with the BACK key. Pressing the BACK key deletes the last keystroke that has been entered. Complete entries can be removed with the CANCEL key.

Values can also be entered with the rotary knob or the cursor keys. The entry is changed in steps and the R&S FSC immediately sets the appropriate entry parameter.

3.2.2   Entering units

To enter a unit for a value entry, terminate the entry with a unit key. Use the unit keys down the right-hand side of the alphanumeric keypad. These keys have multiple assignments which depend on the unit entry expected by the R&S FSC.
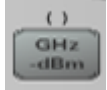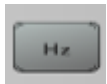
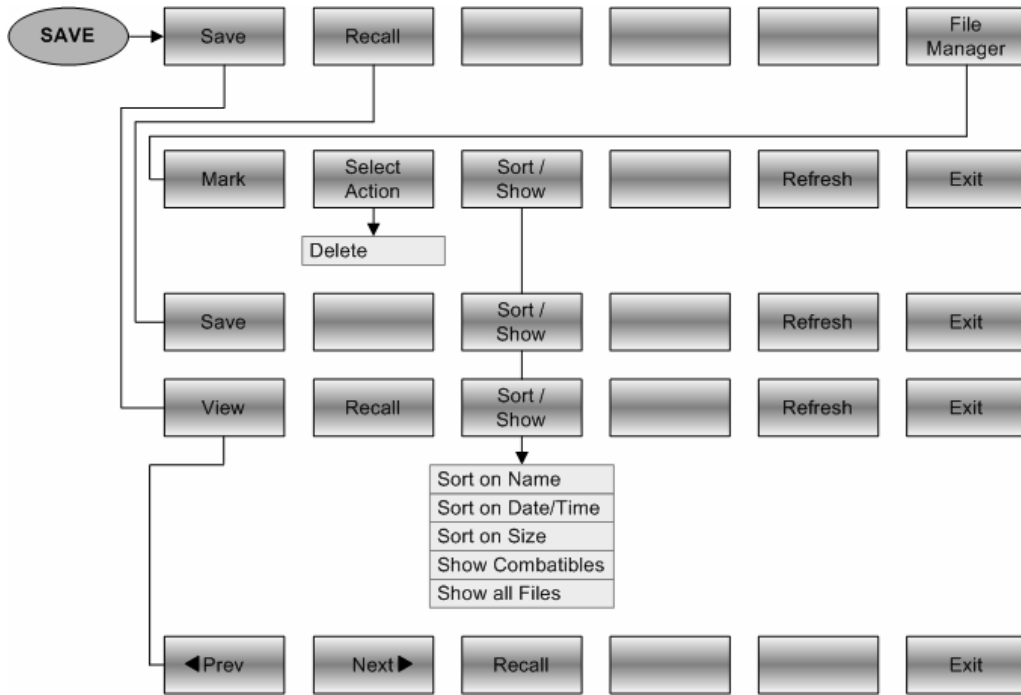GHz, -dBm, V, s

MHz, dBm, dBmV, mV, ms

kHz, dBµV, µV, µs

Hz

The relative level unit dB as well as the unit meter for distances can be entered with any of the unit keys.
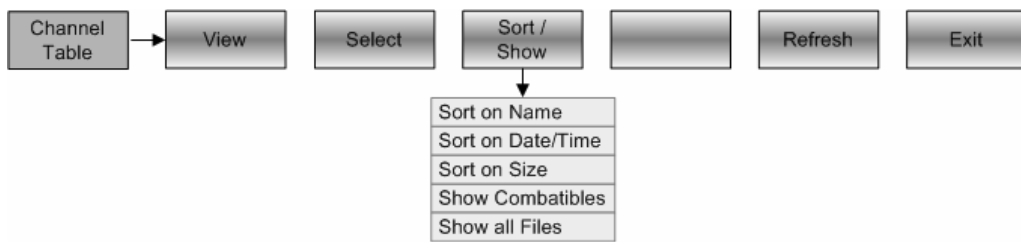
3.3 Menu Overview
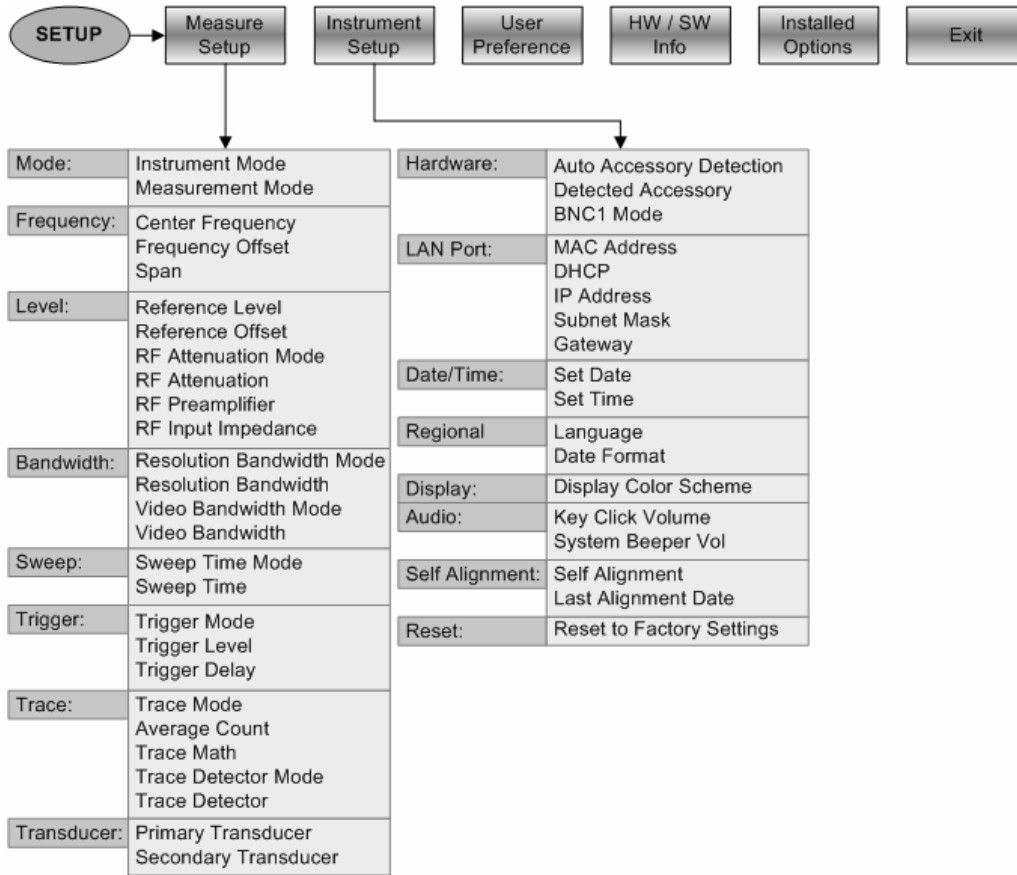
3.3.1 Softkeys available for all measurement modes

3.3.1.1 File management

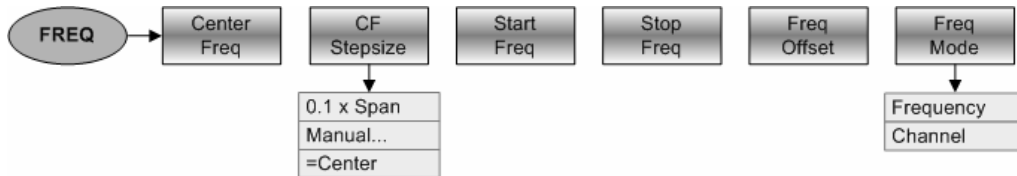#### 3.3.1.2 Table Management

3.3.1.3 General settings

3.3.1.4 Selection of the measurement mode

3.3.2 Softkeys of the spectrum analyzer mode

3.3.2.1 Frequency entry

FREQ → Center Freq | CF Stepsize | Start Freq | Stop Freq | Freq Offset | Freq Mode

CF Stepsize:
- 0.1 x Span
- Manual...
- =Center

Freq Mode:
- Frequency
- Channel

3.3.2.2 Frequency span

SPAN → Manual Span | Full Span | Zero Span | Last Span

3.3.2.3 Level settings

AMPT → Ref Level | Range / Ref Pos | Unit | Ref Offset | RF Att / Amp / Imp | Transducer

Range / Ref Pos:
- Scale Adjust
- 100 dB
- 50 dB
- 20 dB
- 10 dB
- 5 dB
- 2 dB
- 1 dB
- Linear 0-100%
- Ref Position: 10...

Unit:
- dBm
- dBmV
- dBµV
- V
- W
- dBµV/m
- dBµA/m
- W/m²
- dBµV/m

Transducer:
- Primary Transducer
- Secondary Transducer
- Select Primary Transducer
- Select Secondary Transducer

RF Att / Amp / Imp:
- RF Attenuation
- Man: 0 dB
- Auto Low Distortion
- Auto Low Noise
- RF Preamplifier
- Preamp On
- Preamp Off
- RF Impedance
- 50 Ohm
- 75 Ohm RAM
- 75 Ohm RAZ
- 75 Ohm FSH-Z38

3.3.2.4 Bandwidth settings

BW → Manual RBW | Auto RBW | Manual VBW | Auto VBW

3.3.2.5 Sweep

3.3.2.6 Trace settings

3.3.2.7 Limit lines

3.3.2.8 Measurement functions

Channel power

Occupied Bandwidth

TDMA Power

ACP / ACLR

ACLR	→	Meas Mode	Standard		Level Adjust	Channel Settings	Power Unit	Power Display

Channel Settings:
- Tx Channels
- Adj Channels
- Channel BW
- Channel Spacing
- Channel Pwr/Hz
- ACLR Ref Settings
- Channel Limit Relative
- Channel Limit Absolute
- Check Channel Limit

Power Unit:
- dBm
- dBmV
- dBµV
- V
- W
- dBµV/m
- dBµA/m
- W/m^2
- dBµV/m

Power Display:
- Clear/Write
- Max Hold

	Select	Sort / Show		Internal / USB	Exit

Sort / Show:
- Sort on Name
- Sort on Date/Time
- Sort on Size
- Show Combatibles
- Show all Files

Spectrum Emission Mask

SEM	→	Meas Mode	Standard	Adjust Settings			View List

Harmonic Distortion

Harmonic Distortion	→	Meas Mode		Adjust Settings	Harmonics		

AM Modulation Depth

AM Mod Depth	→	Meas Mode		Adjust Settings	Select Marker	Threshold	

3.3.2.9 Marker

3.3.2.10 Marker Position
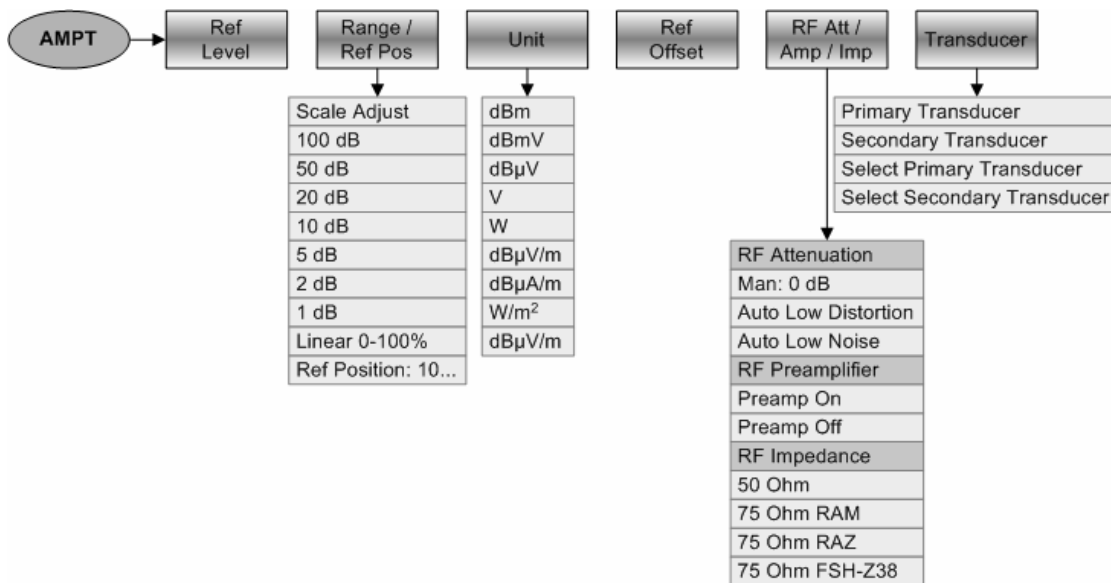
3.3.3 Softkeys of the network analyzer mode

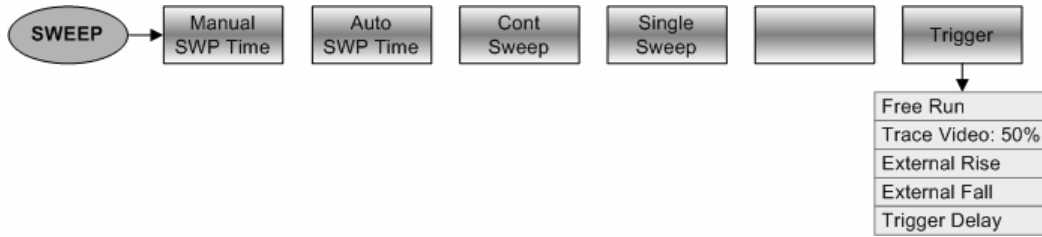#### 3.3.3.1 Frequency entry
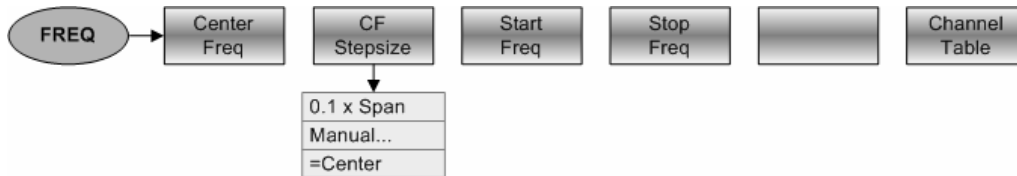
3.3.3.2 Frequency span
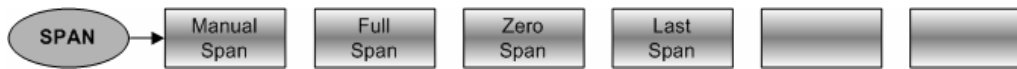
3.3.3.3 Level settings

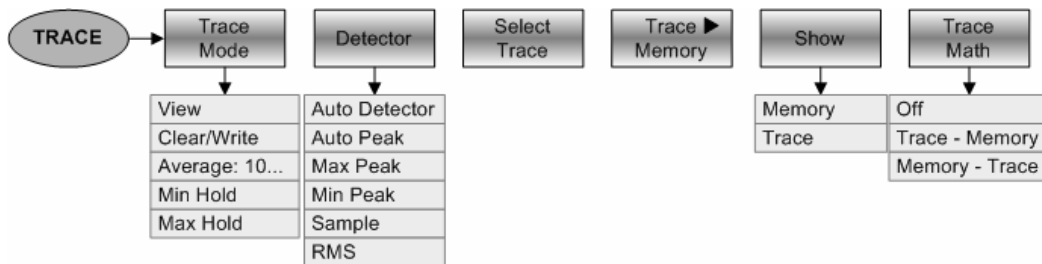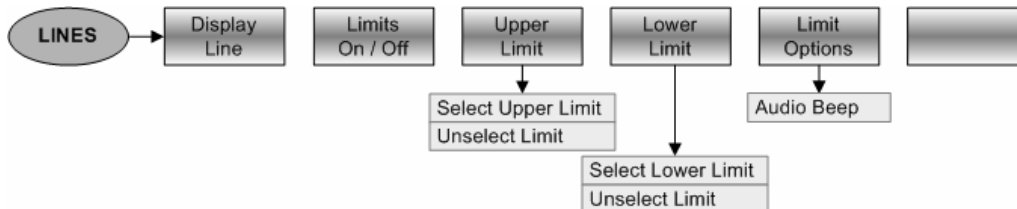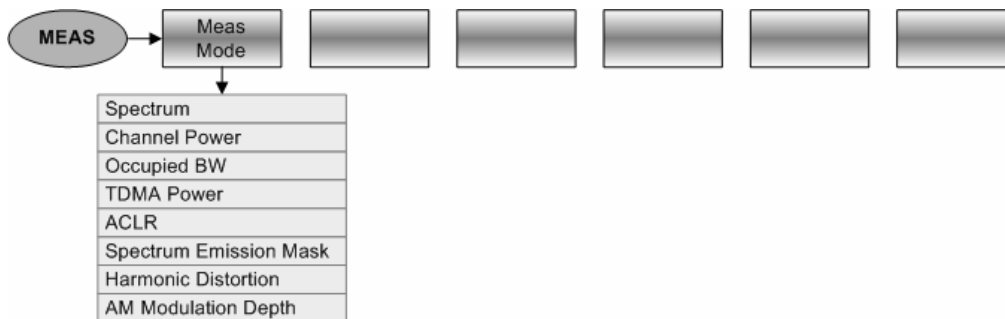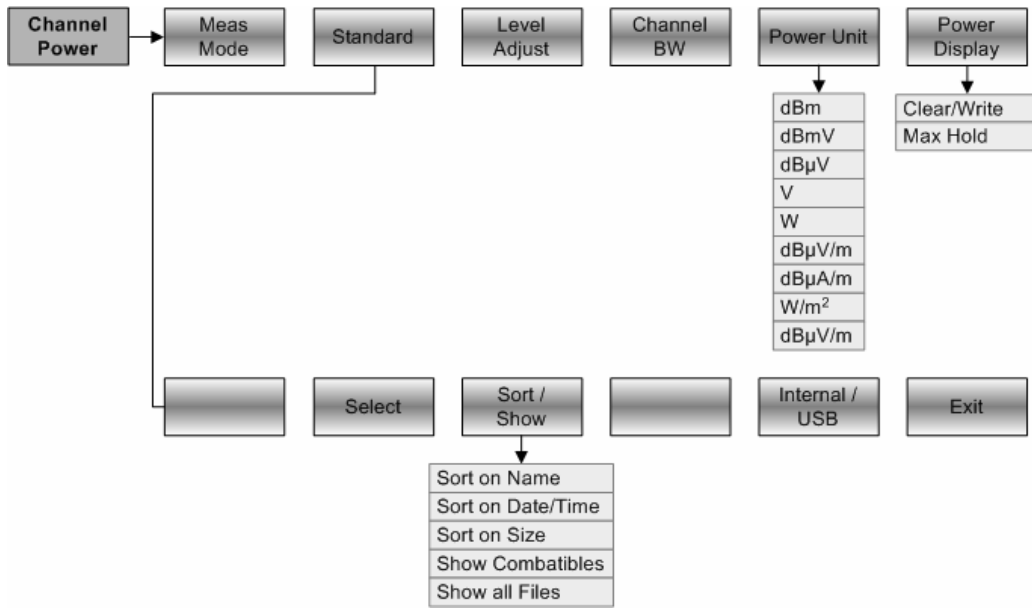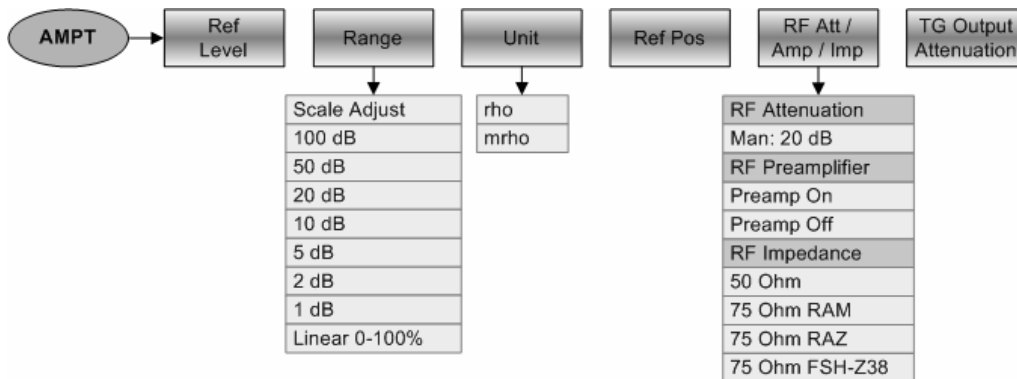#### 3.3.3.4 Bandwidth settings

3.3.3.5 Sweep
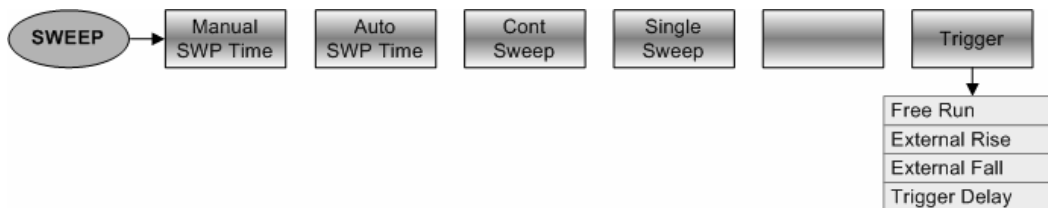
3.3.3.6   Trace settings
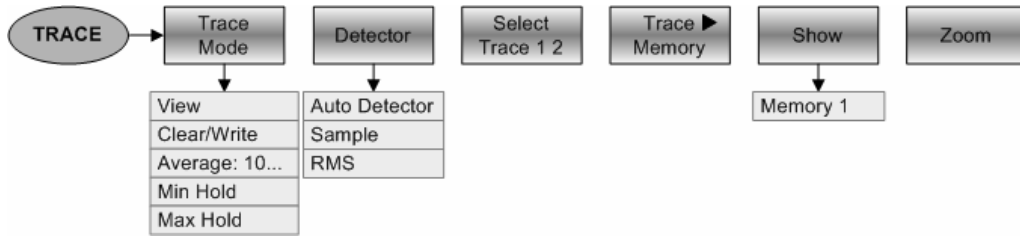
3.3.3.7   Measurement functions
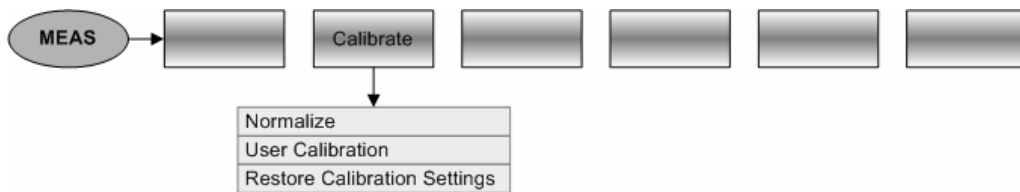
3.3.3.8   Marker
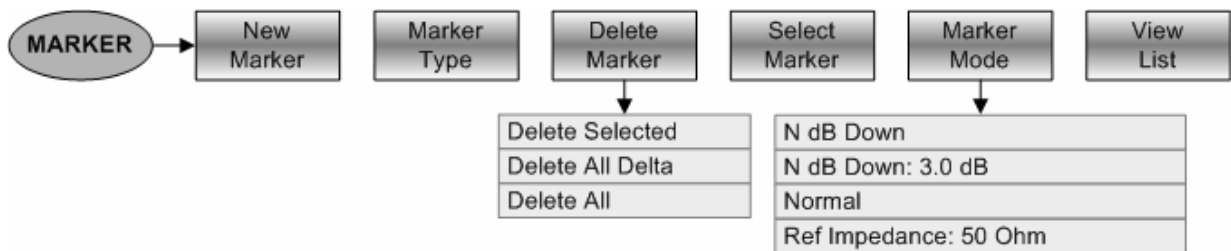
3.3.3.9   Marker position

3.3.4   Softkeys of the Power Meter mode

3.3.4.1   Frequency entry

3.3.4.2   Level settings

3.3.4.3   Sweep

3.3.4.4   Measurement functions
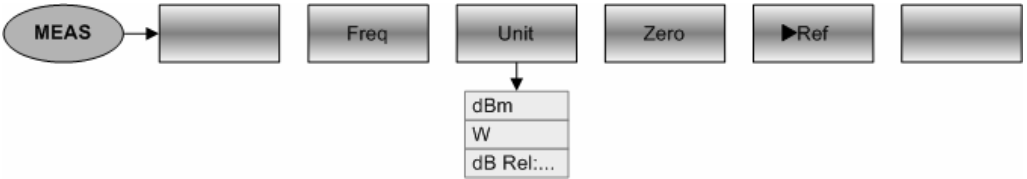
4 Instrument Functions

4.1 Instrument Default Setup

Pressing the PRESET key, sets the R&S FSC to its default setup. It is best to to preset the R&S FSC when you are going to perform a new measurement task. You can then make the new settings on the basis of the more familiar default setup without the old settings affecting the measurement.

➢ Press the PRESET key.

The R&S FSC is immediately set to the default setup.

4.2 Measurement Setup

The measurement setup provides an overview of all current measurement parameters of the active operating mode. This means that all the measurement settings can be checked easily at a glance. The status display can be saved to a file as measurement documentation. By default, the R&S FSC stores a screenshot of the result display in the *.png file format in its internal flash memory. From there it can be transferred to a PC using the R&S FSCView software.

> The measurement setup screen and its contents are customized for each operating mode of the R&S FSC. Therefore, the order and number of displayed settings is different in each mode.

**Operating sequence**

➢ Press the SETUP key.

➢ Press the MEASURE SETUP softkey.

The R&S FSC displays the current measurement parameters on the screen.

➢ Scroll through the setup screen with the rotary knob or the cursor keys to see all settings that do not fit in the display.

There is a scroll bar to indicate whether there are additional parameters in the list.

The display can be used as a way of checking the settings. You can change settings by using the appropriate key and menu.
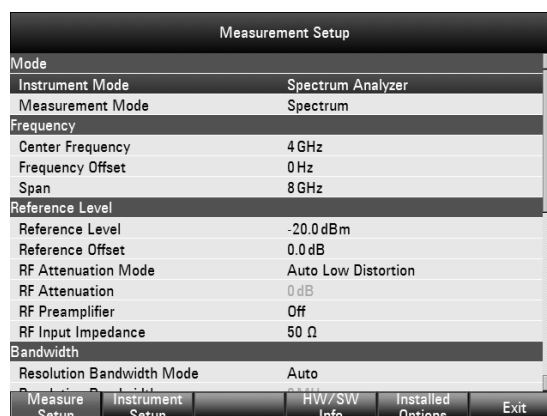
Saving the measurement setup:

➢ Press the USER PREFERENCE softkey.

Select the file format of the screenshot. You can choose the *.png (default) or *.jpg file format.

➢ Press the HCOPY key.

The R&S FSC stores a screenshot in the internal flash memory.

Exiting the measurement setup:

➢ Press the EXIT softkey.

The R&S FSC returns to the original setting.

4.3 Setting the Frequency

The FREQ key sets the R&S FSC's frequency. You can specify the frequency in terms of the center frequency (center freq. = frequency at the center of the frequency axis in the measurement diagram) or the start and stop frequency for a particular span.

It is best to enter the center frequency when you want to measure a signal at a known frequency. When you are investigating signals, e.g. harmonics, that are within a particular frequency range, the best option is entering a start and stop frequency to define the span.

4.3.1 Entering the Center Frequency

➢ Press the FREQ key.

The R&S FSC opens the frequency menu. Center frequency entry is always activated, so that the frequency settings can be made with the minimum number of keystrokes. If inactive, you can open the field with the CENTER FREQ softkey.

The current center frequency is displayed in the value entry box. You can enter a new center frequency directly with the number keys, the rotary knob or the cursor keys.

➢ Enter the frequency you'd like with the number keys

➢ Confirm the frequency entry with the appropriate unit (GHz, MHz, kHz or Hz).

The frequency you have entered becomes the new center frequency. The value entry box remains open for any further entries.

➢ Alternativly, you can change the center frequency with the rotary knob or the cursor keys and confirm the entry with the ENTER key.

➢ Press the CANCEL key to close the entry box.
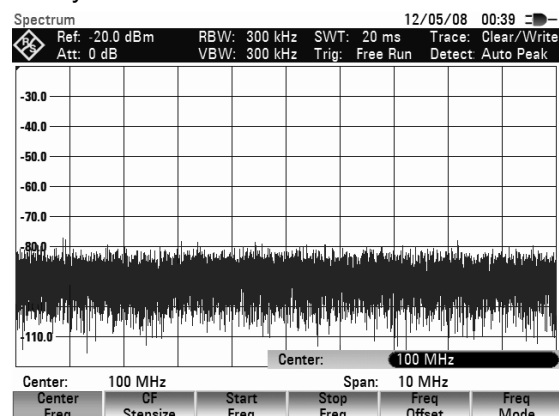
When setting the center frequency with the rotary knob, the smallest possible step is a pixel. As the trace consists of about 631 pixels, each step is equal to 1/630 of the span. When you use the cursor keys, a frequency step is equal to 10 % of the span (= 1 grid division). If you'd like to use a different step size, you can define it with the CF STEPSIZE function (CF = center frequency).

While adjusting the center frequency, you may obtain a value that is outside the R&S FSC's maximum span. If this happens, the R&S FSC automatically reduces the span.

4.3.2   Setting a Frequency Offset

For measurements on frequency converters such as satellite downconverters, it is often convenient to reference the results to the frequency prior to conversion. For this purpose, the R&S FSC offers a frequency offset that arithmetically shifts the center frequency to higher or lower frequencies; thus, the R&S FSC displays the input frequency of the DUT.

Positive frequency offset is possible in the range from 1 Hz to 100 GHz, in steps of 1 Hz. The size of the permitted negative frequency offset depends on the start frequency you have set. The start frequency, taking into account the frequency offset, is always $\geq$ 0 Hz.

> ➤ Press the FREQ key.

> ➤ Press the FREQ OFFSET softkey.
>
> The R&S FSC opens the frequency offset entry field.

> ➤ Enter the required frequency offset

> ➤ Confirm the entry with the corresponding unit.
>
> The R&S FSC adds the frequency offset to the center frequency you have set. A red dot at the center frequency display indicates that a frequency offset has been set.
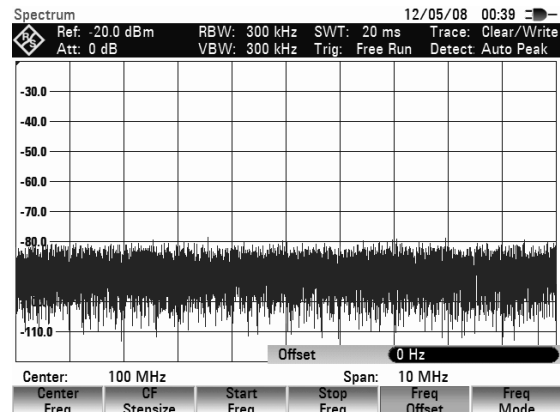
> ➤ Deactivate the frequency offset by entering an offset of 0 Hz.

4.3.3   Entering the Center-Frequency Step Size

> ➤ Press the CF STEPSIZE key.
>
> A submenu to set the step size opens. It contains the following step size options:

- **0.1 x SPAN** (default setting)

  the step size is equal to 10 % of the span (= 1 division on the vertical scale).

- **= CENTER**

  the step size is equal to center frequency. This setting is ideal for measurements on harmonics. On each frequency increment, the center frequency moves to the next harmonic.

- **MANUAL...**

  any step sizeis possible. This makes it easy to investigate a spectrum with frequencies at constant intervals.
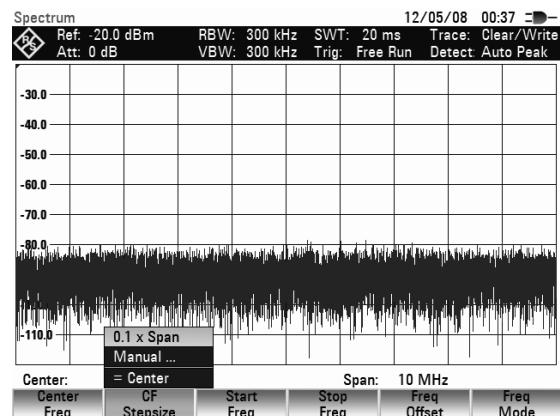
> ➤ Select the stepsize you need with the rotary knob or the cursor keys

> ➤ Confirm the selection with the ENTER key.

If you select "0.1 x SPAN" or "= CENTER", the R&S FSC makes the setting internally. If you select "MANUAL...", the value entry box opens and indicates the current step size.

> ➤ Change the step size with the rotary knob, the cursor keys or the number keys.

> ➤ Confirm the entry with the ENTER key or the CF STEPSIZE softkey.

4.3.4   Entering the Start and Stop Frequency

➢ Press the START FREQ softkey.

   The value entry box for the start frequency opens. The box displays the current frequency.

➢ Define the start frequency with the number keys, rotary knob or cursor keys.

➢ Confirm the entry with the ENTER key or one of the unit keys if you have entered the frequency
   with the number keys.

   The R&S FSC sets the new start frequency. The x axis labelling changes from "Center" and "Span"
   to "Start" and "Stop".

➢ Press the STOP FREQ softkey.

   The value entry box for the stop frequency opens. The box displays the current frequency.

➢ Define the stop frequency with the number keys, rotary knob or cursor keys.

➢ Confirm the entry with the ENTER key or one of the unit keys if you have entered the frequency
   with the number keys.

   The R&S FSC sets the new stop frequency.

If you enter a stop frequency on the R&S FSC which exceeds the maximum stop frequency of the
instrument model, the R&S FSC will set the stop frequency to the maximum permissable stop
frequency. If you reach this frequency limit with the rotary knob or the cursor keys, the R&S FSC will
ignore any further rotary ticks or cursor steps.

4.3.5   Working with Channel Tables

Almost all transmission systems divide their assigned frequency ranges into channels, with a specific
frequency assigned to each channel. The R&S FSC therefore allows you to define channel assignments
using familiar terms to keep operation simple.

You can define channel tables using the R&S FSCView software and load them into the R&S FSC. The
R&S FSC can store more than 100 different channel tables that you can activate via the softkeys. The
maximum number of channel tables may be reduced if transducer factors, cable models, limit values or
data sets are stored simultaneously (see "Saving and Loading Instrument Settings and Measurement
Results" in this manual).

Refer to the manual of the R&S FSCView software for information on how to create channel tables.

Switching to channel entry:

➢ Press the FREQ key.

➢ Press the FREQ MODE softkey.

➢ Select CHANNEL from the submenu with the
   rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key or the FREQ MODE softkey.
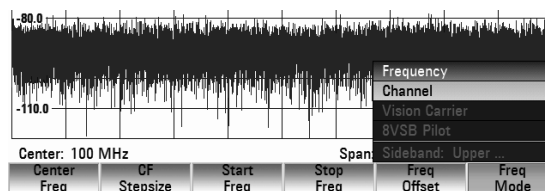
The R&S FSC opens a dialog box that shows all available channel tables that have been loaded into the R&S FSC with R&S FSCView.

➢ Select the channel table you need with the rotary knob or the cursor keys.

➢ If necessary, you can sort the available channel tables by name, date or size using the SORT/SHOW softkey. In addition, you can hide channel tables that are incompatible with the current instrument settings.

➢ Confirm the selection with the SELECT softkey.

The R&S FSC activates the channel table and uses it for future measurements.

To indicate an active channel table, the R&S FSC shows the channel number together with the name of the selected channel (e.g. GSM UL Ch 1) instead of the center frequency. The label of the CENTER FREQ softkey now reads CHANNEL.

The R&S FSC center frequency is the frequency corresponding to the displayed channel number from the channel table. The R&S FSC accepts only channel numbers when entering the center frequency. Tuning the frequency with the rotary knob or the cursor keys is also done using channe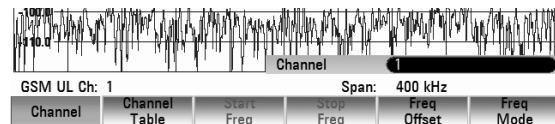l numbers. All other measurement parameters such as SPAN or RBW (resolution bandwidth) are user-selectable as with the entry of frequencies.

The entries for the start frequency (START FREQ) and the stop frequency (STOP FREQ) are inactive when defining channels.

Channel numbers are assigned to frequencies as follows:

• The first channel is assigned a channel number and a frequency.

• All subsequent channels have ascending numbers.

• The frequency spacing between channels is fixed. It can also be negative, i.e. the center frequency of the R&S FSC decreases with ascending channel number.

• In transmission systems containing gaps in the frequency range (as in the case of television, for example), a channel table can comprise multiple ranges.

4.4   Setting the Span

The span is the frequency range centered on the center frequency that a spectrum analyzer displays on the screen. What span should be selected for a particular measurement depends on the signal to be investigated. A rule of thumb is that it should be at least twice the bandwidth occupied by the signal.

For frequency domain measurement the R&S FSC3 has a minimum span of 100 Hz and a maximum span of 3.6 GHz. The maximum span for the R&S FSC6 is 6 GHz.

If you set the span to 0 Hz (zero span), measurements are performed in the time domain.

Operating sequence:

➢ Press the SPAN key.

The R&S FSC opens the span menu. Upon pressing the SPAN key, manual span entry is always actived. If inactive, you can open the entry box with the MANUAL SPAN softkey.

➢ Enter the span you need with the number keys.

➢ Confirm the entry with the appropriate unit (GHz, MHz, kHz or Hz), or

➢ Change the span with the rotary knob or the cursor keys. The span is set immediately after the change is made.

➢ Press the CANCEL key to close the entry box.

➢ Press the FULL SPAN key.
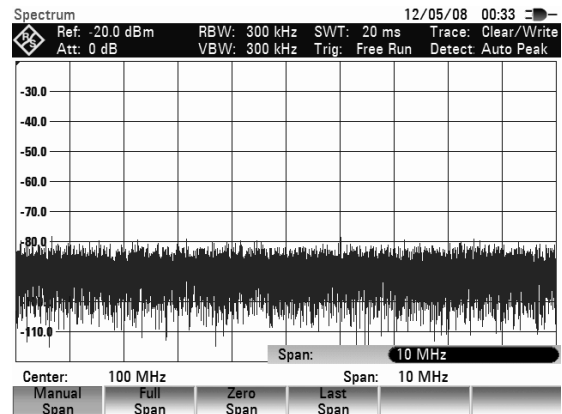
The R&S FSC displays the spectrum over the full span which extends to 3.6 GHz (R&S FSC3) or to 6 GHz (R&S FSC6). (CENTER = 1.8 GHz, SPAN = 3.6 GHz / CENTER = 3 GHz, SPAN = 6 GHz).

The R&S FSC has a LAST SPAN softkey so that you can toggle between span settings with just one keystroke.

➢ Press the LAST SPAN key.

The span that was set immediately before the current span is restored.

The ZERO SPAN softkey sets the span to 0 Hz. The R&S FSC measures the signal level only at the center frequency that has been set. As a spectrum cannot be displayed when measurements are made at a single frequency, the display mode switches to the time domain. The x-axis of the measurement diagram becomes the time axis and level is plotted against time. The display always starts at 0 s and stops after the sweep time that has been set (set with the SWEEP key, see also "Setting the Sweep").

4.5 Setting the Amplitude Parameters

The Amplitude menu contains all settings that relate to level display settings. You can access it via the AMPT key.

The reference level (REF) is the level represented by the uppermost grid line in the measurement diagram. The input signal gain up to the display stage is set with the reference level. If the reference level is low, the gain is high, which means that even weak signals are displayed clearly. If the input signals are strong, a high reference level must be set to prevent an overload of the analyzer signal path and to keep the signal display within the display range. When displaying the spectrum of a composite signal, the reference level should be at least high enough to ensure that all the signals are within the measurement diagram.

The RF attenuation setting at the input of the R&S FSC is directly coupled to the reference level. If the reference level is high, RF attenuation is switched on in steps of 10 dB according to the following table so that the input mixer always remains in the linear range.

The R&S FSC has two different modes for the attenuation setting. You can select the modes with the RF ATT / AMP / IMP softkey. In Auto Low Distortion mode, the R&S FSC sets the RF attenuation 10 dB higher in line with the table, making the stress of the input mixer 10 dB less at the specified reference level. If the spectrum is densely occupied with signals, e.g. in a television cable network, the input mixer reduces the R&S FSC's inherent spurious products. However, the inherent noise display of the R&S FSC increases due to the increased attenuation in front of the input mixer.

In Auto Low Noise mode, the R&S FSC sets the RF attenuation 10 dB lower. This increases the sensitivity of the R&S FSC, which means that the inherent noise display decreases due to the lower attenuation in front of the input mixer.

Reference Level	Preamplifier OFF		Preamplifier ON	
	RF attenuation		RF attenuation	
	Low Noise	Low Distortion	Low Noise	Low Distortion
≤ -30 dBm	0 dB	0 dB	0 dB	0 dB
-29 bis -25 dBm	0 dB	0 dB	0 dB	5 dB
-24 bis -20 dBm	0 dB	0 dB	0 dB	10 dB
-19 bis -15 dBm	0 dB	5 dB	5 dB	15 dB
-14 bis -10 dBm	0 dB	10 dB	10 dB	20 dB
-9 bis -5 dBm	5 dB	15 dB	15 dB	25 dB
-4 bis 0 dBm	10 dB	20 dB	20 dB	30 dB
1 bis 5 dBm	15 dB	25 dB	25 dB	35 dB
6 bis 10 dBm	20 dB	30 dB	30 dB	40 dB
11 bis 15 dBm	25 dB	35 dB	35 dB	40 dB
16 bis 20 dBm	30 dB	40 dB	40 dB	40 dB
21 bis 25 dBm	35 dB	40 dB	40 dB	40 dB
26 bis 30 dBm	40 dB	40 dB	40 dB	40 dB

You can check the status of the RF attenuation and the preamplifier in the measurement setup dialog box (see Measurement Setup).

By default, the reference level is in dBm. However, the units dBmV, dBµV, Watt and Volt are also available. Unit selection is of most relevance to the marker level display as the marker level is displayed in the unit of the reference level.

A reference offset (REF OFFSET) can be defined for the reference level. The reference offset is a way of increasing the reference level by a certain amount. This is useful if, for example, an attenuator or amplifier has been inserted before the RF input. The R&S FSC automatically takes the loss or gain into account when the level is displayed and no manual calculations are necessary. A loss introduced at the RF input must be entered as a positive number and a gain as a negative number.

The measurement range (RANGE) determines the resolution along the level axis in the measurement diagram. When the PRESET or default setting has been selected, the level axis is scaled in dB. The measurement range is 100 dB or 10 dB per division (10 dB/DIV). The R&S FSC also provides the level ranges 50 dB (5 dB/DIV), 20 dB (2 dB/DIV), 10 dB (1 dB/DIV) and 1 dB (0.1 dB/DIV), which enhance the resolution along the level axis. However, increasing resolution does not increase the accuracy of, for example, the marker level readout, but only makes it easier to read values off the trace. You can also select a linear level scale with LIN 0-100 %. The level is expressed as a percentage (0 % to 100 %) of the reference level. This mode is useful if you want to display, for example, a carrier being amplitude modulated in the time domain (SPAN = 0 Hz).

The R&S FSC can also handle measurements on 75 Ω systems. The R&S FSC does not select a 75 Ω RF input per se, but instead only a 75 Ω matching pad connected at the RF input. The 50/75 Ω Matching Pad R&S RAZ is recommended for 75 Ω matching (see recommended accessories). The R&S FSC automatically considers the conversion factor when a value of 75 Ω is set. Other matching pads such as the R&S RAM or R&S FSC-Z38 can be taken into account by using a transducer factor (included with the R&S FSCView control software).

4.5.1   Setting the Reference Level

➢ Press the AMPT key.

The R&S FSC opens the amplitude menu. Upon pressing the AMPT key, reference level entry is always actived. If inactive, you can open the entry box with the REF LEVEL softkey.

➢ Define a reference level with the number keys, rotary knob or cursor keys.

➢ Confirm the entry with the ENTER key or one of the unit keys (-dBm or dBm for relative measurements or (), m, μ, n for absolute measurements) if you have entered the reference level with the number keys.
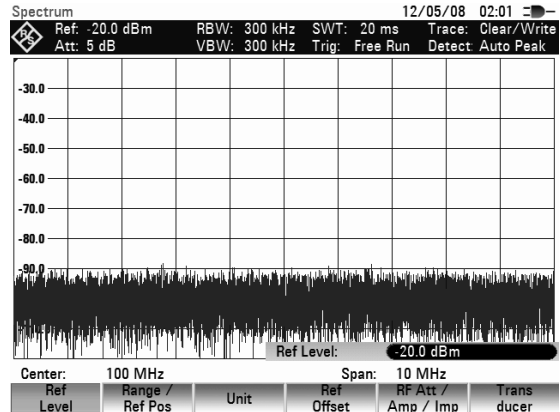
Any changes you make to the reference level with the rotary knob or the cursor keys are immediate. The trace moves as you make changes to the reference level.

➢ Press the CANCEL key to close the entry box.

4.5.2   Entering the Display Range

➢ Press the AMPT key.

➢ Press the RANGE/REF POS softkey.

A submenu opens. The various options for scaling the level axis are displayed.

➢ Select the scaling you need with the rotary knob or the cursor keys.

➢ Confirm your selection with the ENTER key or the RANGE/REF POS softkey.
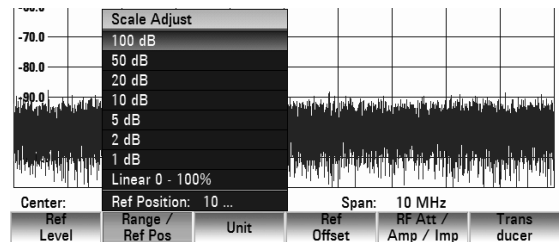
The R&S FSC sets the scaling option you have chosen immediately.

You can define the position of the reference level by moving the trace to another grid line to display signals that would normally overlap with the top border of the diagram.

➢ Press the RANGE/REF POS softkey.

➢ Select REF POSITION: 10 with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key.

A entry box opens.

➢ Select the grid line you want with the number keys, the rotary knob or the cursor keys. '10' corresponds with the upper grid line, '0' to the lower grid line.

➢ Confirm the entry with the ENTER key.

A triangle marks the current position of the reference level on the selected grid line.
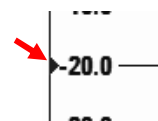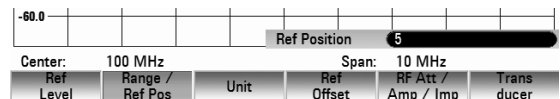
4.5.3   Entering the Display Unit

➢ Press the AMPT key.

➢ Press the UNIT softkey.

A submenu opens. The various unit options for the reference level are displayed.

➢ Select the unit you want with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key or the UNIT softkey.

The R&S FSC immediately switches the unit.
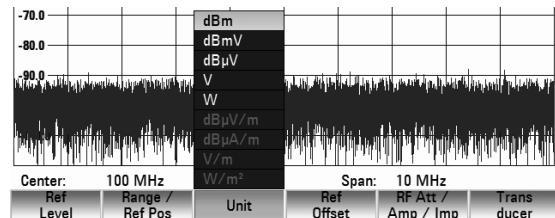
4.5.4   Entering the Reference Offset

➢ Press the AMPT key.

➢ Press the REF OFFSET softkey.

➢ Enter the reference offset you need with the number keys, rotary knob or cursor keys.

➢ Confirm the entry with the ENTER key or one of the unit keys if you have entered the reference offset with the number keys.

The reference offset unit is always dB – no matter what unit is used for the reference level.

A red dot in front of the reference level display indicates that a non-zero reference offset has been set.
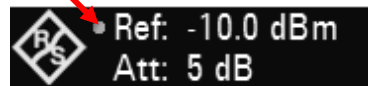
4.5.5   Entering of the RF-Attenuation

➢ Press the AMPT key.

➢ Press the RF ATT/AMP/IMP softkey.

The R&S FSC opens a submenu to select RF ATTENUATION, RF PREAMPLIFIER and RF IMPEDANCE.

The RF attenuation can be preset at your discretion to between 0 dB and 40 dB in 5 dB steps ("Man:" entry), or set automatically to low sensitivity to interfering signals ("Auto Low Distortion" setting) or to high input sensitivity ("Auto Low Noise" setting).

➢ Select the item you want with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key.
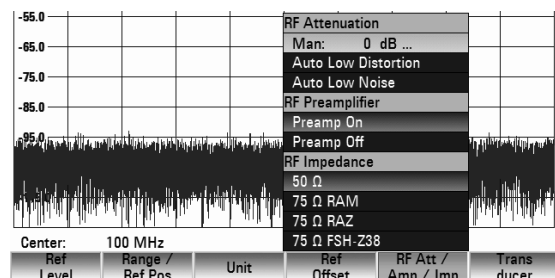
A red dot in front of the RF Attenuation display indicates that manual ('Man:') selection of the attenuation has been set.
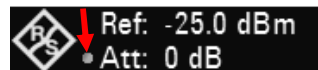
4.5.6   Switching the RF Preamplifier on/off

To increase the input sensitivity, the R&S FSC has an integrated 20 dB preamplifier upstream of the input mixer. This is switched off in the default state. You can switch it on to measure low power signals.

➢   Press the AMPT key.

➢   Press the RF ATT/AMP/IMP softkey.

The R&S FSC opens a submenu to select RF ATTENUATION, RF PREAMPLIFIER and RF IMPEDANCE.

➢   Select PREAMP ON or PREAMP OFF with the rotary knob or the cursor keys.

➢   Confirm the selection with the ENTER key.

4.5.7   Entering the Input Impedance

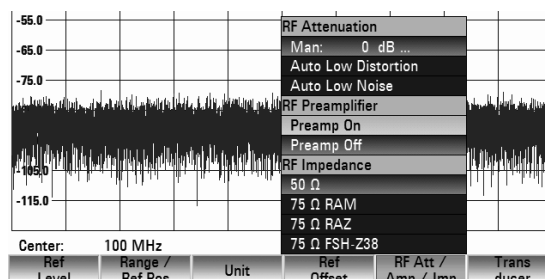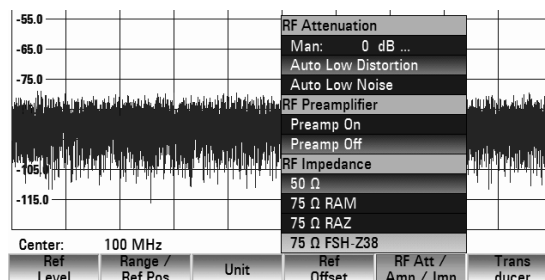➢   Press the AMPT key.

➢   Press the RF ATT/AMP/IMP softkey.

A submenu opens. The two input impedance options "50 Ω" and "75 Ω" are displayed.

➢   Select the input impedance you need with the rotary knob or the cursor keys.

➢   Confirm the selection with the ENTER key..

ⓘ   If you have selected 75 Ω, and do not connect a matching pad to the RF input, level readings will be incorrect.

4.5.8   Selecting a Transducer Factor

In many cases, the R&S FSC is not connected directly to the output of the device under test. Instead, the signal comes via a cable, amplifier, antenna or a combination of these.

The R&S FSC can account for the frequency shifts of up to two connecting components in the measured results. For this purpose, so called transducer factors have been defined. You can load transducer factors into the R&S FSC with the R&S FSCView software. Each transducer factor consists of a list of frequency/level pairs that describe the frequency shift of the measuring accessory. For antennas, the unit of the measured electrical or magnetic field strength is included, for isotropic antennas in each case the frequency stage for the x-, y- and z-directions.

For more information on how to create and edit transducer factors refer to the R&S FSCView manual.

You can enable two inputs (Primary and Secondary Transducer) from the list of transducer factors available for the R&S FSC, in order to take, for example, a combination of cable and antenna or cable and amplifier into account. Note that only one of the two transducers in use may have a unit other than "dB".

➢ Press the AMPT key.

➢ Press the TRANSDUCER softkey.

The R&S FSC opens a submenu to select the primary and secondary transducer factors.

➢ Select the SELECT PRIMARY TRANSDUCER menu item with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key.

A list of factors that are available as primary transducer factors opens.

➢ Select the transducer factor you need with the rotary knob or the cursor keys.

➢ Confirm the selection with the SELECT softkey.

In the transducer submenu, the PRIMARY TRANSDUCER menu item is check marked.
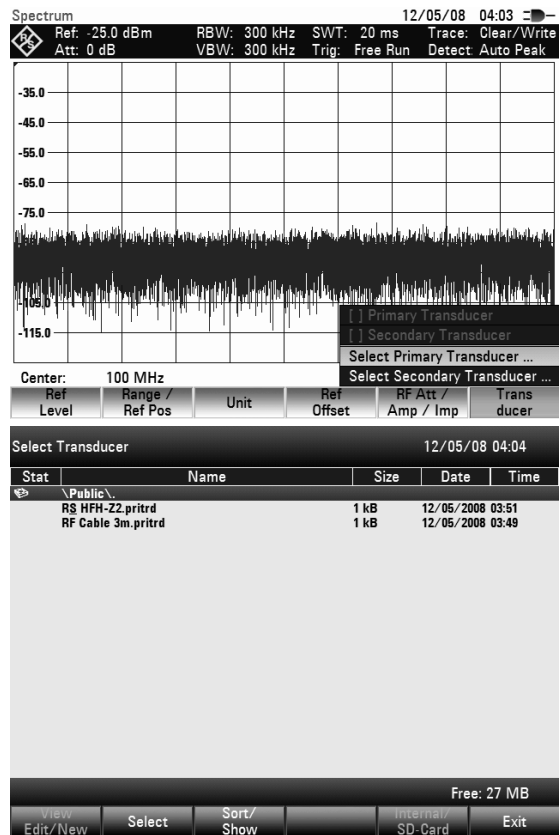
The R&S FSC displays the transducer factor in use in addition to the entry field of the reference level.

To select an additional transducer factor, use the menu entry SELECT SECONDARY TRANSDUCER and proceed as described above.

To switch off a selected transducer factor, proceed as follows:

➢ Press the AMPT key.

➢ Press the TRANSDUCER softkey.

The R&S FSC opens a submenu to select primary and secondary transducer factors.

➢ Select the PRIMARY TRANSDUCER or SECONDARY TRANSDUCER menu item with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key.
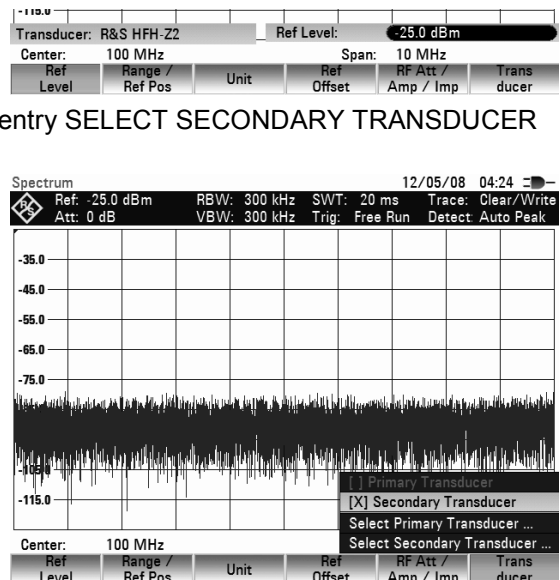
The transducer factor is no longer included in the level display.

4.6   Setting the Bandwidths

A key feature of a spectrum analyzer is that it can display the frequency spectrum of a signal. The resolution bandwidth determines how well a spectrum analyzer can separate adjacent frequencies. Spectrum analyzers usually also have adjustable video bandwidths. The video bandwidth is determined by the cutoff frequency of the lowpass used to filter the video voltage before it is displayed. The video voltage is the spectrum analyzer term for the voltage produced when the IF signal that has been band-limited by the resolution filter is envelope detected. The video voltage is smoothed by video filtering to, say, reduce noise on the trace. Unlike the resolution bandwidth, the video bandwidth has no effect on the resolving power of the spectrum analyzer.

4.6.1   Resolution Bandwidth

The resolution bandwidth (RES BW) of a spectrum analyzer determines the frequency resolution of spectrum measurements. A sine signal is displayed on the screen "through" the passband of the selected resolution filter. Therefore, a suitably small resolution bandwidth is required if two or more signals whose frequencies are close together are to be displayed separately. The frequency difference between two sinusoidal carriers, for example, cannot be less than the selected resolution bandwidth if the carriers are to be resolved.

The resolution bandwidth that you select also has an effect on the noise displayed by the spectrum analyzer. If the bandwidth is small, the displayed noise drops. If you reduce or increase the bandwidth by a factor of 3, the displayed noise drops or goes up by 5 dB. If the bandwidth is changed by a factor of 10, the displayed noise changes by 10 dB.

The resolution bandwidth you select also has an effect on the sweep speed. If the true spectrum is to be displayed, the bandfilters that determine the resolution bandwidth must settle at all frequencies of interest. Narrow bandfilters take longer to settle than wide filters. This is why you have to set a longer sweep time for narrow resolution bandwidths. If the bandwidth is reduced by a factor of 3 (e.g. from 10 kHz to 3 kHz), the sweep time must be increased by a factor of 9. If the reduction factor is 10 (e.g. from 10 kHz to 1 kHz) the sweep time must be increased by a factor of 100.

The R&S FSC has resolution bandwidths from 1 Hz to 3 MHz in a 1, 3, 10 sequence. In the R&S FSC's default state, the resolution bandwidth is coupled to the span, i.e. if the span is reduced, the R&S FSC automatically applies a smaller resolution bandwidth. In turn this means that you do not have to set the resolution bandwidth separately in many cases – a higher frequency resolution is automatically set when the span is reduced.

All models offer a 200 kHz resolution bandwidth in addition. This bandwidth has to be selected manually, i.e. it will not be activated automatically in the AUTO RES BW mode (resolution bandwidth coupled to span).

Operating sequence:

➢ Press the BW key.

The menu to select the bandwidth opens. By default, the AUTO RBW softkey is active (green).

➢ Press the MANUAL RBW softkey

The RBW entry box opens. It shows the current bandwidth.

A red dot in front of the RBW display indicates that the resolution bandwidth is no longer coupled to the span.

➢ Enter the resolution bandwidth you want with the number keys and confirm the entry with the appropriate unit (MHz, kHz or Hz), or

➢ Select the resolution bandwidth with the rotary knob or the cursor keys and confirm the selection with the ENTER key.
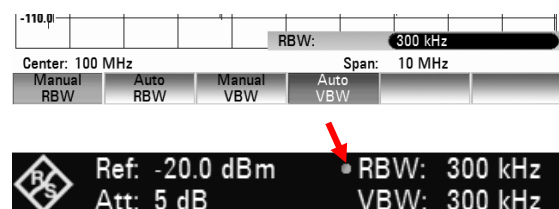
➢ Press the CANCEL key to close the entry box.

➢ Press the AUTO RES BW softkey.

The resolution bandwidth again is coupled to the span. The AUTO RBW softkey label is highlighted in green to show that the coupled mode has been selected.

The red dot in front of the RBW display disappears.

ℹ **Setting the 200 kHz resolution bandwidth**

You have to enter the 200 kHz resolution bandwidth with the number keys.

When using the rotary knob or the cursor keys, the 200 kHz bandwidth will be skipped.


ℹ **Automatic adjustment of the sweep time**

In its default mode the R&S FSC automatically adjusts the sweep time as soon as you change the resolution bandwidth. This is to make sure that the settling time required for the selected resolution filter is properly taken into account. The maximum allowed sweep time is 1000 s. For narrow resolution filters this value would be exceeded for large spans. In order to avoid this the R&S FSC adjusts the span automatically as soon as the maximum sweep time is reached.

4.6.2 Video Bandwidth

The video bandwidth smoothes the trace by reducing noise. When the filtered IF signal is envelope-detected, an IF sine signal becomes a DC voltage in the video signal. If the sine signal is amplitude-modulated, a signal whose frequency is the same as the AM frequency is produced in the video signal apart from the DC voltage from the carrier. The figure below shows an RF signal modulated with a sine signal and the corresponding video signal in the time domain.
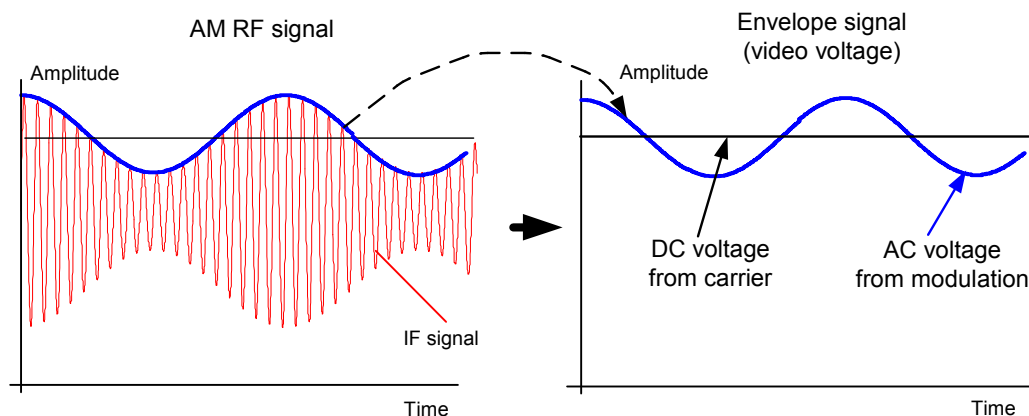
The envelope signal contains a DC component corresponding to the carrier level and an AC component whose frequency is the same as the AM frequency. If the bandwidth of the video filter is less than the frequency of the AC component, the latter will be suppressed depending on its maximum frequency. If the AM component is to be displayed faithfully, the cutoff frequency must be greater than the modulation frequency.

If there is noise on the sine signal, the modulation signal can be thought of as noise. If the video bandwidth is reduced, the high-frequency noise components above the cutoff frequency of the video filter will be rejected. The smaller the video bandwidth, the smaller the noise amplitude at the video filter output.

Therefore, the following rules of thumb can be applied to setting the video bandwidth:

- If you are performing measurements on modulated signals, the video bandwidth must be sufficiently large so that desired modulation components are not rejected ($\geq$ RBW).

- If signals are to be kept free of noise, the smallest video bandwidth possible should be selected ($\leq$0.1 x RBW).

- If measurements are being performed on pulsed signals, the video bandwidth should be at least three times greater than the resolution bandwidth so that the pulse edges are not distorted.

Like the resolution bandwidth, the video bandwidth has an effect on sweep speed. The spectrum analyzer must pause before each measurement to allow the video filter to settle.

The R&S FSC has video bandwidths from 1 Hz to 3 MHz in a 1, 3, 10 sequence. When the default settings are selected, they are coupled to the resolution bandwidth. The video bandwidth equals the resolution bandwidth. When the resolution bandwidth is changed, the R&S FSC automatically sets the appropriate video bandwidth. This means that, in many cases, the video bandwidth does not need to be set separately. When the resolution bandwidth is changed, the video bandwidth is changed automatically.

Operating sequence:

➢ Press the BW key.

The menu for setting bandwidths opens. When the default setting has been selected, the softkey label for setting the bandwidth automatically is highlighted in green.

➢ Press the MANUAL VBW softkey.

The VBW entry box opens. It shows the current bandwidth.

A red dot in front of the VBW display indicates that the video bandwidth is no longer coupled to the resolution bandwidth.
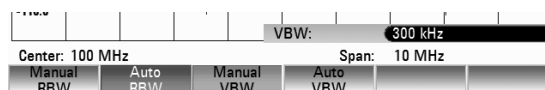
➢ Enter the video bandwidth you want with the number keys and confirm the entry with the appropriate unit (MHz, kHz or Hz), or

➢ change the video bandwidth to the value you want using the rotary knob or the cursor keys.

➢ Press the CANCEL key to close the entry box.

➢ Press the AUTO VBW softkey.

The video bandwidth again is coupled to the resolution bandwidth. The AUTO RBW softkey label is highlighted in green to show that the coupled mode has been selected.

The red dot in front of the RBW display disappears.
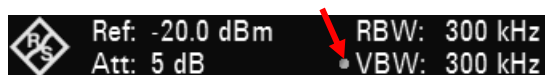
4.7   Setting the Sweep

If the span is > 0, the sweep time is the time the spectrum analyzer takes to traverse the displayed span to measure the spectrum. Certain boundary conditions must be met if a spurious spectrum is not to be displayed.

One boundary condition is the resolution bandwidth. If the resolution filter is to settle, the dwell time within the filter bandwidth must have the right value. If the sweep time is too short, the resolution filter does not settle and the displayed level is too low (see also "Setting the Bandwidths").

The second boundary condition is the selected span. If the span is increased, the sweep time must be increased proportionally.

The R&S FSC provides automatic sweep time coupling to help users set the sweep time by coupling it to the resolution bandwidth and span that have been set. When automatic coupling (AUTO SWEEP

TIME) is selected, it always sets the shortest sweep time possible to ensure that sine signals in the spectrum are displayed correctly. If you activate manual sweep time, a red dot in front of the SWP display indicates that the sweep time is no longer coupled to the resolution bandwidth and the span. If the sweep time is so short that level errors occur, the R&S FSC informs you by displaying a red circle in the measurement diagram.

The R&S FSC requires a minimum sweep time of 20 ms per 600 MHz of span. If you set a larger span, the R&S FSC automatically adapts the minimum sweep time in the coupled mode.

If the span = 0 Hz, the R&S FSC displays video voltage versus time instead of a spectrum. The x-axis of the measurement diagram becomes the time axis. It starts at 0 s and ends at the sweep time you have selected.

The minimum sweep time when the span = 0 Hz is 200 µs, the maximum 1000 s.

4.7.1   Sweep Time

➢   Press the SWEEP key.

    The softkey menu for entering sweep parameters opens. By default, automatic coupling (AUTO SWP TIME) is active. In this mode, the sweep time is coupled to the resolution bandwidth, the video bandwidth and the span.

➢   To enter the sweep time, press the MANUAL SWP TIME softkey.

    The Sweep Time entry box opens. It shows the current sweep time.
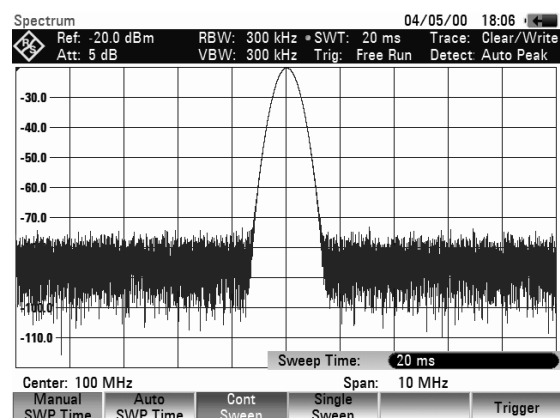
➢   Enter a new sweep time with the number keys and confirm the entry with one of the unit keys, or

➢   change the sweep time with the rotary knob or the cursor keys and confirm the entry with the ENTER key.

    Whenever you make a change, the sweep time is immediately set to its new value. The SWT readout shows the current sweep time.

➢   Press the CANCEL key to close the entry box.

4.7.2   Sweep Mode

When the default settings are active, the R&S FSC is in the continuous sweep mode, i.e. when one sweep of the span has been completed, the sweep is automatically repeated from the start of the span. The trace is updated after each sweep.

The continuous mode may not be needed for some applications, e.g. when a single event is to be recorded on certain trigger conditions being met. Therefor, the R&S FSC has a SINGLE SWEEP mode. When the single sweep mode is selected, the R&S FSC sweeps once over the span or displays the time-domain video signal once in the zero-span mode. The measurement will only be repeated if you press the SINGLE SWEEP softkey.

> Press the SWEEP key.

By default, continuous sweep mode (CONT SWEEP) is active.

> Press the SINGLE SWEEP softkey.

The SINGLE SWEEP softkey label turns green. The R&S FSC performs a single sweep and waits for further entries.

> Press the CONT SWEEP softkey.

The R&S FSC sweeps continuously again.
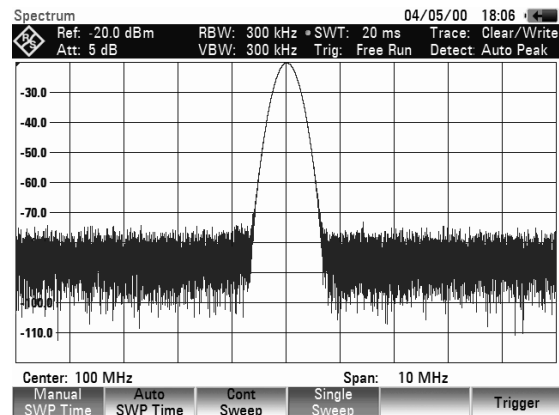
4.7.3   Trigger

To respond to events, the R&S FSC has a variety of trigger functions. The trigger can either be external or generated internally.

- FREE RUN   A new sweep starts on completion of the previous sweep. This is the default setting for the R&S FSC.

- VIDEO   A sweep starts when the video voltage exceeds a certain value you can set. Video triggering is only available in zero span mode (span = 0 Hz). When a frequency spectrum is being displayed, (span $\geq$ 10 kHz), there is no guarantee that a signal that generate a video voltage is present at the start frequency. Under these circumstances, the R&S FSC would never perform a sweep.

- EXTERNAL RISE /   A sweep starts on the rising edge (RISE) or on the falling edge (FALL) of an
  EXTERNAL FALL   external trigger signal. The external trigger signal is fed in via the BNC connector EXT TRIGGER. The switching threshold is 1.4 V, i.e. a TTL signal level.

- GATED TRIGGER   When the gated trigger is active, a gate signal that is applied to the R&S FSC trigger input controls the sweep. The R&S FSC starts measuring when the applied gate signal becomes active and the set gate delay has expired, and it interrupts the measurement as soon as the defined gate length is reached. With the gate signal becoming active the next time the measurement is resumed etc. Pulsed signals can be measured by this method, if the gate delay and gate length are selected in a way that the measurement is only performed while the pulse is active. Gated measurement is possible in the frequency domain (span > 0) and the time domain (span = 0), but it is available only in combination with an external gate signal.

When video trigger or external trigger are selected, you can delay the start of the measurement with respect to the trigger event by entering a delay time (DELAY). In this way, time differences between the trigger event and the measurement can be allowed for.

The trigger readout (TRIG) shows the current trigger setting.

Operating sequence:

> Press the SWEEP key.

> Press the TRIGGER softkey.

The submenu for setting the trigger opens. By default, Free Run is active.

In zero span mode (span = 0 Hz), you can select any trigger. If the span > 0, the Video and Delay items are not available.

➢ Select the setting you want with the rotary knob or the cursor keys

➢ Confirm the selectiob with the ENTER key or the TRIGGER softkey.

   The trigger readout (TRIG) shows the current trigger setting.
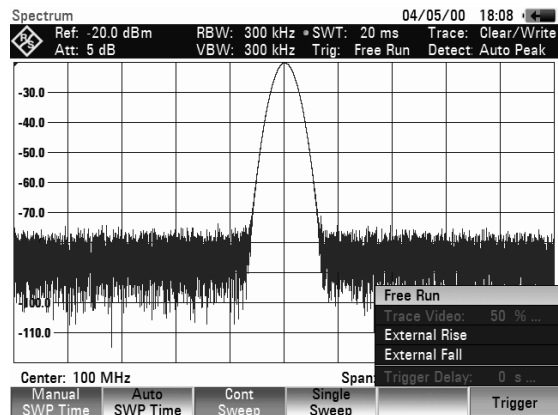
If you have selected the VIDEO... trigger, you have to specify the trigger level and any trigger delay (DELAY...). The trigger level is expressed as a percentage (%) of the reference level. 100% means that the trigger level equals the reference level, 50% that the trigger level is in the middle of the y axis of the trace diagram (default setting). The position of the video trigger on the level axis is shown by a ">".

➢ Press the TRIGGER softkey.

➢ Select the TRACE VIDEO menu item with the rotary knob or the cursor keys.

➢ Change the video-trigger threshold with the cursor keys or the rotary knob (0 to 100 %).

➢ Confirm the selection with the ENTER key or the TRIGGER softkey.

    The entry box closes. The trigger threshold is set immediately after entry.

➢ If you require a trigger delay, press the TRIGGER softkey.

➢ Select the DELAY... menu item with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key or the TRIGGER softkey.

    The R&S FSC opens a entry box to enter the delay time.
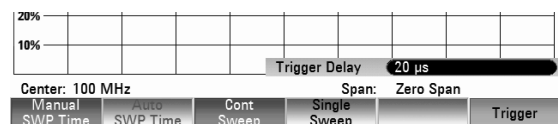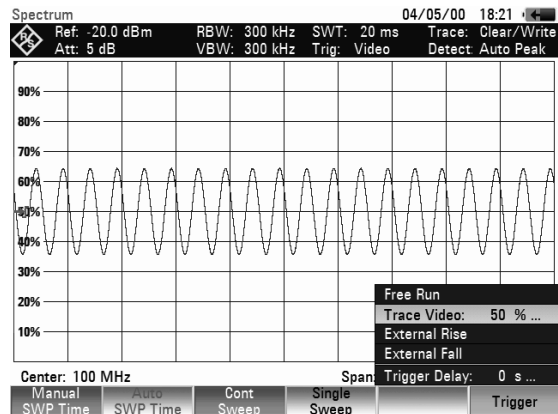
➢ Enter the delay time with the number keys, the rotary knob or the cursor keys.

➢ Confirm the entry with the ENTER key or one of the unit softkeys, if you have entered the delay time with the number keys.

The range for the trigger delay is 0 µs to 100 s. The resolution depends on the selected delay time.

The table below lists the delay time resolution values:

Trigger delay (DELAY)	Resolution
0 to 1 ms	10 µs
1 ms to 10 ms	100 µs
10 ms to 100 ms	1 ms
100 ms to 1 s	10 ms
1 s to 10 s	100 ms
10 s to 100 s	1 s

When the external trigger is active (EXTERNAL RISE or EXTERNAL FALL), it is possible to activate a gated sweep.

➢ Press the SWEEP key.

➢ Press the TRIGGER softkey.

➢ Select EXTERNAL RISE or FALL with the rotary knob or the cursor keys to enable the external trigger.

➢ Confirm your selection with the ENTER key or the TRIGGER softkey.
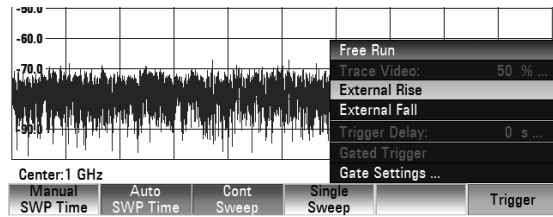
Now that the external trigger is active, the GATED TRIGGER becomes available for selection.

➢ Press the TRIGGER softkey again.

➢ Select the GATED TRIGGER menu item with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key or the TRIGGER softkey.

The gated sweep is now active.
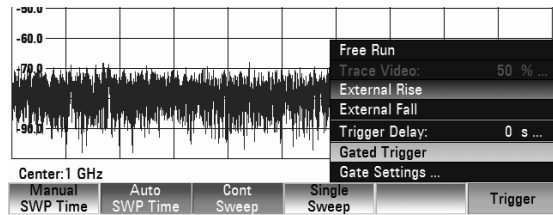
In order to get appropriate results, the gate delay and gate length must be set in a way that the measurement is active during the interesting part of the signal. You can also modify the sweep time in order to match the x-axis to the length of the signal and therefore set the gate delay and gate length parameters more accurately.

The gate delay parameter defines the time between the trigger event and the beginning of the actual measurement. The gate length defines the duration of the measurement, before it is interrupted and the next gate signal is anticipated to resume the measurement.

To define the gate delay and the gate length, proceed as follows:

➢ Press the TRIGGER softkey.

➢ Select GATE SETTINGS with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key.

The R&S FSC opens a softkey submenu that controls the gate settings. At the same time, the R&S FSC switches into time domain (span = 0), as indicated in the display.

➢ Press the MANUAL SWP TIME softkey and set the sweep time in a way that the portion of interest of the signal is visible on the screen.

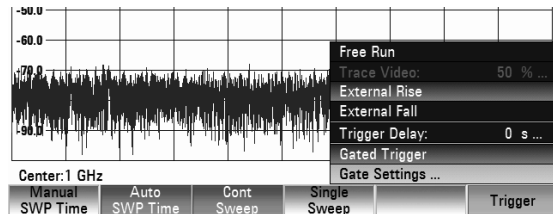➢ Press the GATE DELAY softkey to define the time when the measurement should start.
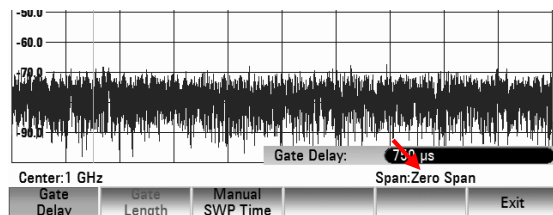
➢ Enter the delay time you need with the number keys, the rotary knob or the cursor keys.

➢ Confirm the entry with the ENTER key.

➢ Press the GATE LENGTH softkey to define the duration of the measurement, before it is interrupted and the next gate signal is anticipated.

The delay time and gate length are represented by vertical red lines in the diagram area.

➢ After setting the gate delay and gate length, exit the gate settings menu with the EXIT softkey.

The R&S FSC returns to the frequency domain provided it was active before setting up the gated trigger. The original span is restored. The R&S FSC is ready to perform measurements with an accurately set gate.

4.8 Trace Settings

The R&S FSC provides a measurement trace and two reference traces in memory.

4.8.1 Trace Mode

A variety of display modes can be selected for the trace:

- **CLEAR/WRITE**

  The R&S FSC clears the old trace during a new sweep. This is the default setting.

- **AVERAGE**

  The R&S FSC takes the level average over consecutive traces. In the default setting, averaging is on a pixel-by-pixel basis, sliding over the ten previous traces. Alternatively, you can set the number of averagings between 2 and 999. This reduces the effects of noise, for example, but has no effect on sine signals. The average mode, therefore, makes it easy to display sine signals in the vicinity of noise.

- **MAX HOLD**

  The trace indicates the maximum value that has been measured up to that point in time. The Max Hold mode is only cancelled if another setting is selected and the trace pixels from the new setting cannot be compared with the trace pixels from the previous setting – for example if the span is changed. Intermittent signals in the spectrum or the maximum of fluctuating signals are easy to find with MAX HOLD.

- **MIN HOLD**

  The trace indicates the minimum value that has been measured up to that point in time. The Min Hold mode is only cancelled if another setting is selected and the trace pixels from the new setting cannot be compared with the trace pixels from the previous setting – for example if the span or the center frequency is changed. With MIN HOLD, sine signals within the noise can be highlighted or intermittent signals suppressed.

- **VIEW**

  The R&S FSC freezes the presently displayed trace. The measurement is aborted. This, for instance, allows subsequent evaluation of spectra with the aid of the marker.

Operating sequence:

➢ Press the TRACE key.

➢ Press the TRACE MODE softkey.
  The submenu for setting the trace mode opens.

➢ Select the trace mode you want with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key or the TRACE MODE softkey.
  The "Trace:" display shows the current trace mode.

If you select the AVERAGE trace mode, the AVG COUNT entry box opens. It displays the number of averagings the R&S FSC performs.
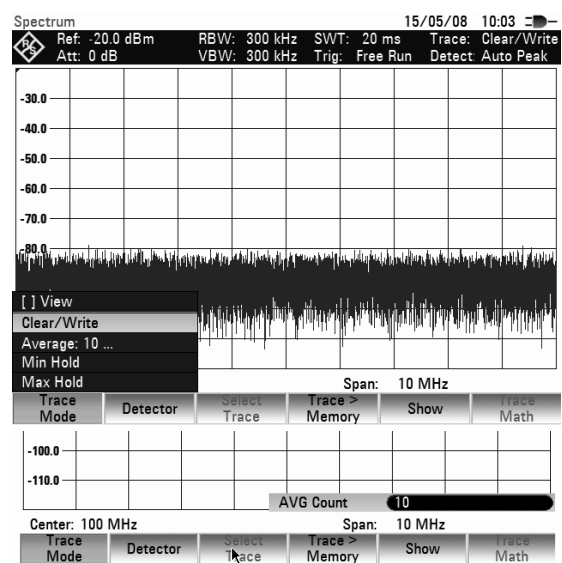
You can perform the following actions:

➢ Confirm the displayed number of averagings with the TRACE softkey or the ENTER key.

➢ Enter a new value between 2 and 999 with the number keys. Confirm the new number of averagings with the ENTER key.

➢ Change the number of averagings with the rotary knob. Confirm the entry with the ENTER key.

  The R&S FSC averages the pixels of the trace across the set number of averagings.

If the sweep is continuous, the R&S FSC then performs a sliding averaging. In the SINGLE SWEEP mode, it performs exactly those sweeps defined with AVG COUNT and averages the traces. It then stops the sweep and displays the averaged trace.

In the trace mode VIEW, the settings used for measuring the trace are displayed. This ensures that the measurement conditions can be clearly specified in result documentation.

4.8.2   Detector

The detector processes a spectrum analyzer's video voltage before it is displayed. The detector is pixel-oriented, i.e. it determines how the level at each pixel will be displayed. The R&S FSC always measures the whole spectrum. However, the trace only has 631 pixels in the x direction for displaying results. If a large span is selected, all the spectrum information must somehow be represented using only 631 points. Each pixel represents a frequency range equal to span/631. Four different detectors are available:

- **AUTO PEAK**

  When the Auto Peak detector is selected, the R&S FSC displays the maximum and minimum level at each pixel for the frequency range in question. This means that when Auto Peak detection is selected no signals are lost. If the signal level fluctuates, as is the case with noise, the width of the trace is a measure of signal fluctuation. Auto-peak detection is the default setting.

- **MAX PEAK**

  Unlike the Auto Peak detector, the Max Peak detector only finds the maximum value within the frequency range associated with one trace pixel. Its use is recommended for measurements on pulse-like signals or FM signals.

- **MIN PEAK**

  The Min Peak detector yields the minimum value of the spectrum within a pixel of the trace. Sine signals are displayed with correct level but noise-like signals are suppressed. The Min Peak detector can be used to highlight sine signals in the noise spectrum.

- **SAMPLE**

  The Sample detector does not "summarize" any aspect of the spectrum which is available in its complete form in the R&S FSC, but instead shows only one arbitrary measurement point within a pixel. The Sample detector should always be used for measurements with span = 0 Hz, as this is the only way of correctly representing the timing of the video signal. The Sample detector can also be used to measure noise power as noise usually has a uniform spectrum with a normal amplitude distribution. If the Sample detector is used for signal spectrum measurements with a span that is greater than (resolution bandwidth x 631), signals may be lost.

- **RMS**

  The RMS detector measures spectral power over a pixel. No matter what the signal shape, power measurements with the RMS detector always give the true power. RMS detection is recommended for power measurements on digitally modulated signals in particular. This is because the RMS detector is the only R&S FSC detector that can give stable, true power readings. Display stability can easily be obtained by increasing the sweep time, as the measurement time for the power/pixel increases the greater the sweep time. If you are making noise measurements, for example, the trace will be highly stable if a long sweep time is selected.

However, the bandwidth occupied by the signal to be measured should at least equal the frequency covered by a trace pixel or the selected resolution bandwidth (whichever is larger). Otherwise, the power shown by the R&S FSC is too low because there are spectral components within the frequency range covered by the pixel which do not come from the signal under measurement (e.g. noise).

To obtain the true power, the video bandwidth (VBW) too should be selected to be greater than the resolution bandwidth (RBW). Otherwise, an averaging effect caused by video bandlimiting comes into play before the RMS value is calculated.

Both automatic operation and manual operation are available for setting the detector. In automatic operation, the R&S FSC selects the detector that is suitable for the trace mode that is set. In manual operation, the selected detector is always maintained regardless of the trace mode.
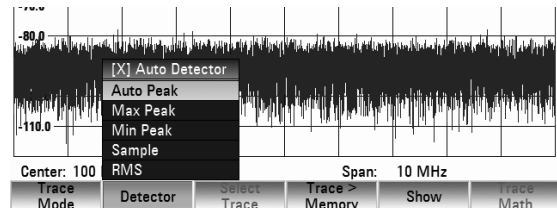
Setting of the detector in automatic operation:

Trace mode	Detector
Clear/Write	Auto Peak
Average	Sample
Max Hold	Max Peak
Min Hold	Min Peak

Operating sequence:

➢ Press the TRACE key.

➢ Press the DETECTOR softkey.

The submenu for selecting the detector opens.

If automatic operation has been selected, the AUTO DETECTOR menu item is marked with X and the R&S FSC displays the detector that is set to match the trace mode that is set.

Switching automatic operation on and off:

➢ Select the AUTO DETECTOR menu item with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key or the DETECTOR softkey.

The R&S FSC puts a check mark in front of the AUTO DETECTOR menu item to indicate that the function is active [X] or inactive [ ].

When automatic operation is active, the R&S FSC also sets the detector that matches the current trace mode.

Selecting the detector manually:

➢ Select the detector you want to use with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key or the DETECTOR softkey.

The "DETECT:" display shows the current detector.

If AUTO DETECTOR is switched on and a detector that does not accommodate automatic operation is set, the R&S FSC will switch automatic operation off.

4.8.3   Trace Memory

The R&S FSC can transfer a trace to the trace memory and also display the current trace and the trace in the trace memory for comparison. The saved trace is always displayed in white to distinguish it from the current trace.

Operating sequence:

➢   Press the TRACE key.

➢   Press the TRACE -> MEMORY softkey.
    The R&S FSC transfers the trace to the trace memory.

➢   Press the SHOW softkey.

➢   Select the memory trace from the menu with the rotary knob or the cursor keys.

➢   Confirm the selection with the ENTER key.
    The R&S FSC displays the saved trace in white. The menu entry of the selecte memory trace is marked with an [X] to indicate that the trace in the trace memory is being displayed.
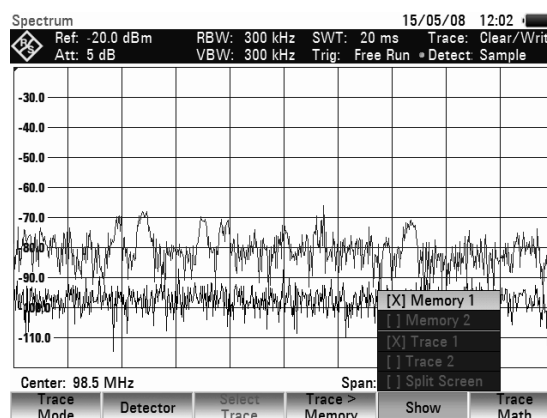
➢   To remove the memory trace from the screen, press the SHOW softkey again.

➢   In the menu select the memory trace marked by an [X]

➢   Confirm with the ENTER key.
    The selected memory trace will be removed from the screen.

> The memory traces are bit-mapped into the picture memory. Therefore, when the memory trace is recalled, it will not be adapted to any modifications of the reference level or span that may have been made in the meantime.
>
> When a stored data set is called, the R&S FSC stores the associated trace in the trace memory. The stored trace can be displayed with SHOW MEMORY.

4.8.4   Trace Mathematics

The R&S FSC can subtract a saved trace from the active trace and display the difference.

Operation sequence:

➢   Press the TRACE key.

➢   Press the TRACE > MEMORY softkey.
    The R&S FSC transfers the currently displayed trace to the trace memory.

➢   Press the SHOW softkey. Select the memory trace and confirm your selection with ENTER.
    The R&S FSC displays the memory trace in white.

> ➢ To remove the memory trace from the screen, press the SHOW softkey again. Select the memory trace marked by an [X]

> ➢ Confirm the selection with the ENTER key.

> ➢ Press the TRACE MATH key and select TRACE – MEM or MEM – TRACE.
>
> The R&S FSC displays the difference between the saved trace and the active trace.

> ➢ To remove the saved trace from the screen, press the TRACE MATH softkey again and select OFF.
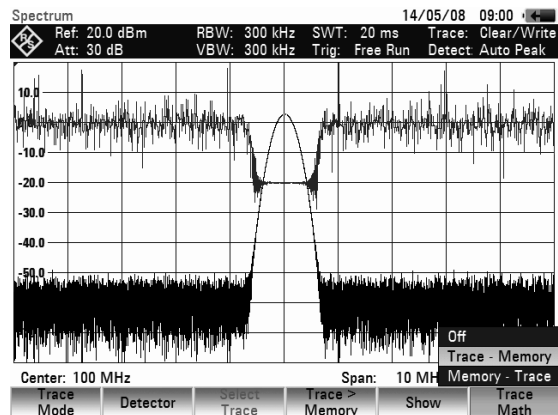
4.9   Using Markers

The R&S FSC has six markers, five of which can be used as either marker or delta marker.

The markers cannot leave the trace and indicate the frequency and level of the point they are positioned on. The frequency indicated by a marker is shown by a vertical line which extends from the top to the bottom of the measurement diagram. A list above the trace diagram shows the frequency and level position of the markers in question. The level unit of the marker is the same as that of the reference level.

The position of a delta marker is indicated by a dashed line to distinguish it from a normal marker. The delta marker level is always a relative to the main marker level and so the delta marker level unit is always dB. The delta marker frequency is always relative to the main marker – in other words, the delta marker frequency is the frequency difference between the frequency at the point marked by the main marker and the frequency at the point marked by the delta marker.

① Marker frequency
② Marker level
③ Deltamarker frequency
④ Deltamarker level
⑤ Marker symbol
⑥ Deltamarker symbol
⑦ Marker
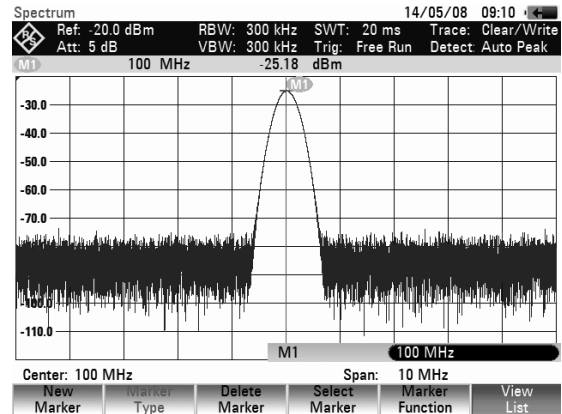⑧ Deltamarker
⑨ Marker menu
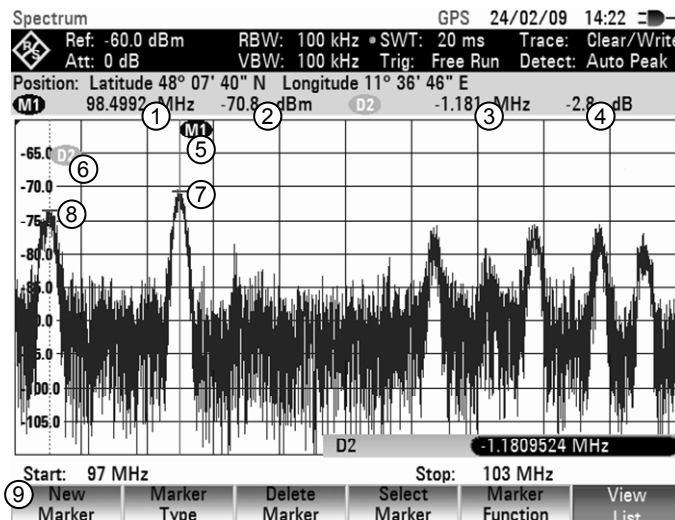
4.9.1   Controlling Markers

Controlling a marker

➢ Press the MARKER key.

The marker menu opens.

If, as yet, no marker has been activated, the main marker (MARKER) is turned on automatically and placed on the maximum level of the spectrum. In addition, the value entry box for the marker frequency opens.
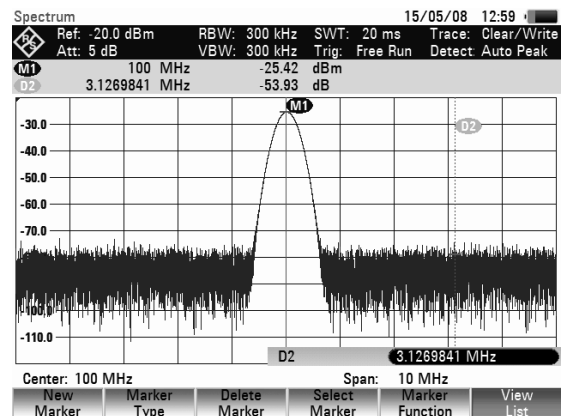
You can perform the following actions:

➢ Change the marker position with the rotary knob or the cursor keys.

➢ Enter a marker position with the number keys and confirm the entry with one of the unit keys.

➢ Confirm the marker position with the ENTER key.

Controlling a delta marker:

➢ Press the MARKER key.

➢ Press the NEW MARKER softkey.

The R&S FSC activates the delta marker and places it on the second largest signal of the trace.

The marker list above the diagram shows the marker position relative to the normal marker (M1). The R&S FSC always shows the frequency difference and the level difference between the points marked by the main marker and the delta marker. Simultaneously, the value entry box for the delta marker frequency difference opens.

You can perform the following actions:

➢ Enter a delta marker position with the number keys and confirm the entry with one of the unit keys.

➢ Change the delta marker position with the rotary knob or the cursor keys.

➢ Confirm the delta marker position by pressing the ENTER key.

4.9.2   Automatic Marker Positioning

The R&S FSC offers functions that make setting the markers easier or allow to make instrument settings on the basis of the current marker position:

- **PEAK**

  The Peak function places the marker or the delta marker on the highest level value of the trace. The function acts on the active marker.

- **NEXT PEAK**

  The Next Peak function places the active marker or delta marker on the next highest level value of the trace, relative to its current position.

- **MINIMUM**

  The Minimum function places the marker or delta marker on the lowest value of the trace. The function acts on the active marker.

  When the trace is displayed in the CLEAR/WRITE mode, the marker is placed on the lowest maximum of the trace.

- **CENTER = MKR FREQ**

  The Center = MKR function adjusts the center frequency to the current marker or delta marker frequency, depending on which marker is active.

  This function is particularly useful if you want to investigate a signal more closely using a smaller span. You can do this by first placing the signal in the center of the span and then reducing the span.

- **REF LVL = MKR LVL**

  The Ref Lvl = MKR Lvl makes the current marker level the reference level. This makes it easy to optimize the R&S FSC's level display range if the levels being investigated are low.

Operating sequence

➢ Press the MKR-> key.

➢ Press the softkey with the function you want.
  The R&S FSC performs the action you have selected.
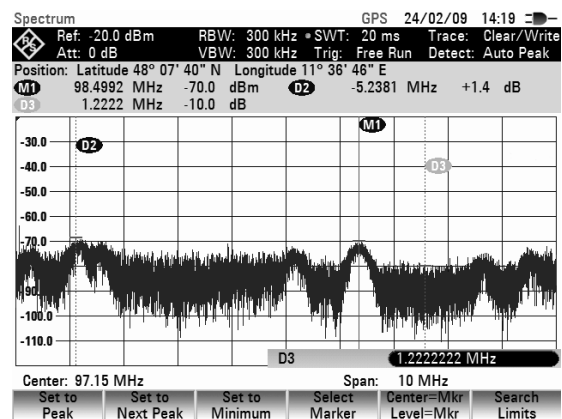
Using marker search limits

The R&S FSC allows you to use only a limited section of the trace for the PEAK, NEXT PEAK and MINIMUM functions. This is beneficial, for example, if you want to sample only spurious emissions with the marker search functions and want to omit useful signals.

➢ Press the SEARCH LIMITS softkey.

➢ Select SEARCH LIMITS ON/OFF with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key or the SEARCH LIMITS softkey.

The R&S FSC activates the marker search limits. [X] marks an active search limit. Two vertical lines show the left and right limits in the diagram.

➢ Press the SEARCH LIMITS softkey again to define the marker search range.
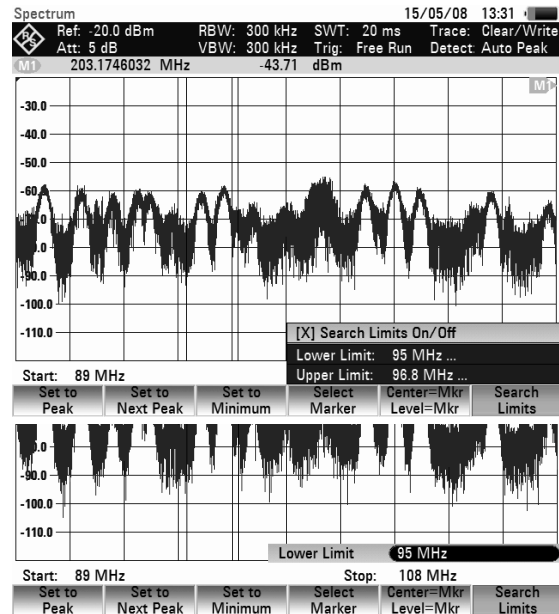
➢ Select the LOWER LIMIT menu item with the rotary knob or the cursor keys

➢ Confirm the selection with the ENTER key or the SEARCH LIMITS softkey.

The R&S FSC opens the entry box to define the start frequency of the search range.

➢ Enter a start frequency with the number keys.

➢ Confirm the entry with one of the unit keys or

➢ Select the start frequency with the rotary knob or the cursor keys and confirm the entry with the ENTER key.

The R&S FSC indicates the start of the search range by a vertical line in the diagram.

The procedure for entering the stop frequency for the search range is analogous to that for entering the start frequency.

Deactivating marker search limits

If you activate marker search limits, the SEARCH LIMITS softkey in the marker to menu turns green. In addition, an [X] in front of the SEARCH LIMITS ON/OFF menu item indicates an active search range. To deactivate the marker search range,

➢ Press the SEARCH LIMITS softkey.

➢ Select the SEARCH LIMITS ON/OFF menu item with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key or the SEARCH LIMITS softkey.

The softkey SEARCH LIMITS is no longer highlighted and the [X] in front of the SEARCH LIMITS ON/OFF menu item disappears.

4.9.3   Using more than One Marker at a Time (Multimarker Mode)

To measure different signals in a trace, the R&S FSC has the multimarker function. Up to six different markers are available. Marker 1 measures in absolute units. Markers 2 to 6 can measure in absolute units (marker) as well as relative units (delta). The reference for delta markers is always marker 1.

Working with several markers

➢ Press the MARKER key.

➢ Press the NEW MARKER softkey several times. On each key-press, the R&S FSC creates a new marker and places it on the next lower signal peak.

    The marker label contains the number and type of the marker in question (M1, D2, D3 etc.). M stands for a normal marker, D stands for a delta marker. The label of the active marker has a red background, while the other markers have a grey background.

    The first marker you create (M1) is always a normal marker. All other markers are by default delta markers, i.e. their position is displayed relative to marker 1.

➢ Press the MARKER TYPE softkey in order to transform a delta marker into a normal marker.

    The marker label changes (e.g. D2 -> M2), and the marker position is displayed in absolute values.

In order to select a previously created marker, press the SELECT MARKER softkey repeatedly until the label of the desired marker turns red.

The R&S FSC opens the entry box for the frequency of the selected marker or the spacing between the delta marker and the reference marker M1.

➢ Place the marker or delta marker near the position you want it in with the cursor keys.

    When moving the marker with the cursor keys, the step size is 10% of the x-axis.

➢ Fine-tune the marker or delta marker to the signal with the rotary knob.

    When moving the marker with the rotary knob, the step size corresponds to the pixel spacing of the trace.

➢ Alternatively, enter the position you want the marker or delta marker in with the number keys and confirm the entry with one of the unit keys.

    The marker label of the marker or delta marker you have edited last, i.e. the active marker, is red. All marker functions always relate to the active marker.
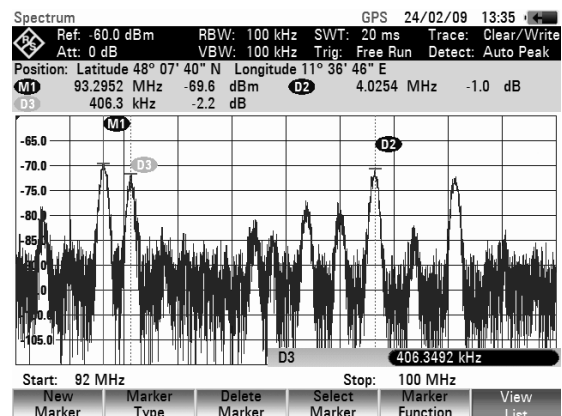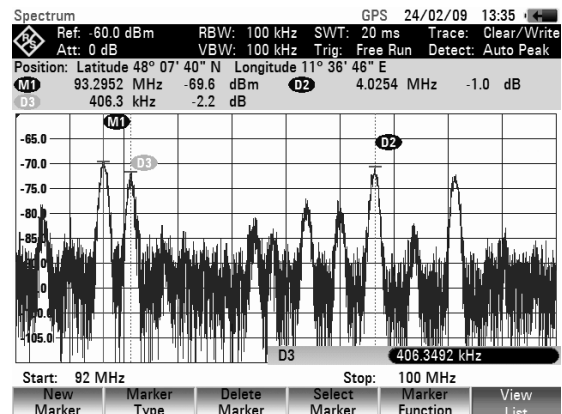
Automatic marker positioning

Automatic positioning of markers in multimarker mode is similar to that of the normal marker. The different functions always apply to the active marker, which is also indicated for the various functions in the MKR-> menu (example: Selected Marker to Peak).

In addition, it is possible to position all active markers (M1 through M6) on the peak of a trace.

➢   In the SET TO PEAK menu, select ALL MARKERS

➢   Confirm this with the ENTER key or the SET TO PEAK softkey.

    The R&S FSC sets all active markers on the maxima of the trace.
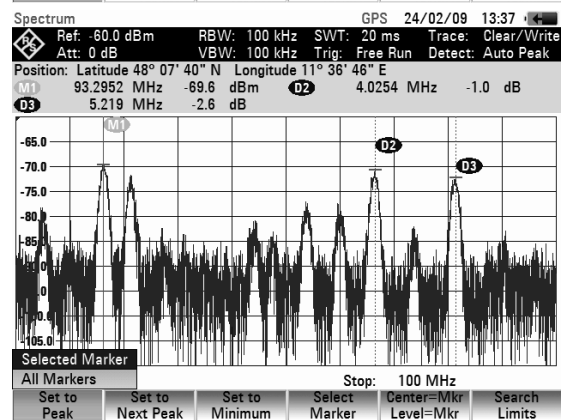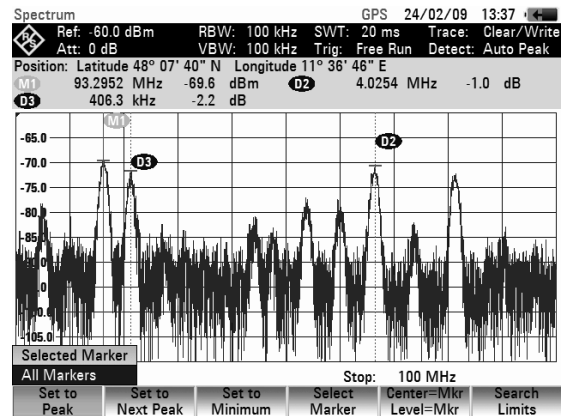
Displaying the marker list

The R&S FSC can display a list of all active markers and delta markers and their values.

➢   Press the VIEW LIST softkey.

    The R&S FSC displays a list of all active markers and delta markers.

If you press the VIEW LIST softkey again, the R&S FSC closes the marker table extension from marker 3 to 6.

By default, the marker list is active.

Deactivating markers

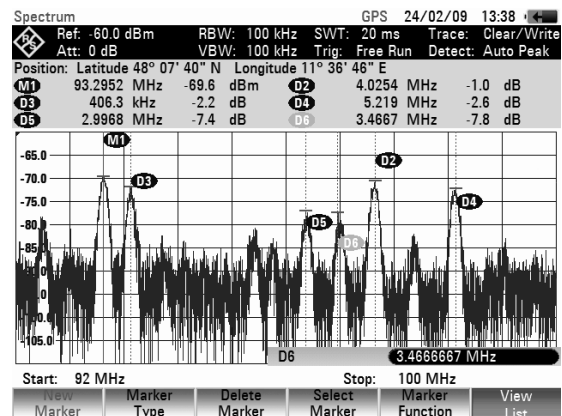Markers can be deactivated one at a time or all at once.

➢ To deactivate markers one at a time, press the SELECT MARKER softkey repeatedly until the marker or delta marker you want to delete turns red.

The entry box for the selected marker appears.

➢ Press the DELETE MARKER softkey.

➢ Select the DELETE SELECTED menu item with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key.

The R&S FSC deletes the selected marker.

➢ To deactivate all markers at once, press the DELETE MARKER softkey.

➢ Select the DELETE ALL DELTA or DELETE ALL menu item with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key or the DELETE MARKER softkey.

The R&S FSC deletes all markers and/or delta markers.
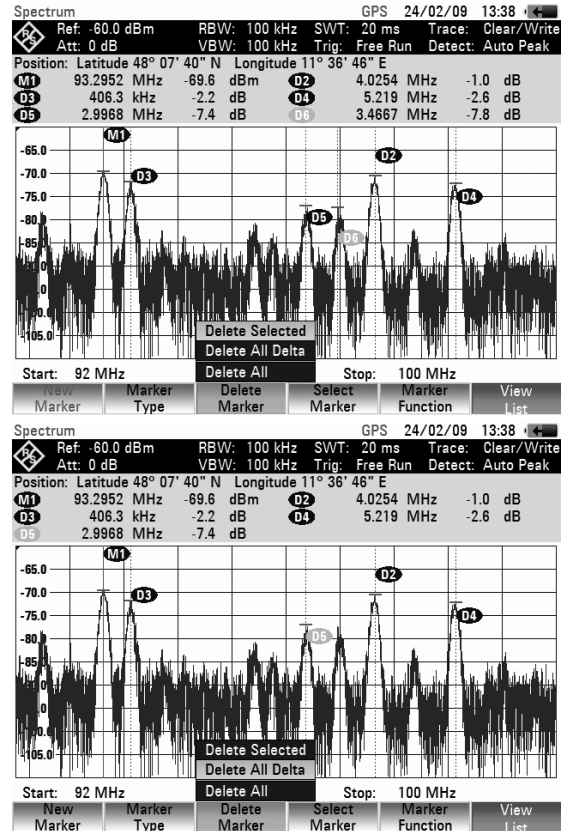
Deactivating normal markers

If you deactivate normal markers, the R&S FSC also deactivates all delta markers, because they use marker 1 as a reference.

4.9.4   Marker Functions

Apart from displaying the level and frequency at the marker position (NORMAL setting), the R&S FSC can also perform other forms of analysis at the marker position. For example, the R&S FSC can calculate the noise power density referred to 1 Hz bandwidth (NOISE function) or measure the frequency of a signal at the marker position (FREQ COUNT function). The filter bandwidth or the signal bandwidth is measured with the N DB DOWN function.

Deactivating marker functions

To return to normal marker mode, enter the marker function menu (MARKER FUNCTION softkey) and select the active marker function again. Confirm your selection with the ENTER key.

4.9.4.1   Measuring the Noise Power Density

The NOISE function is used to calculate the noise power density at the marker position. The R&S FSC calculates the noise power density in dBm/(1 Hz) from the trace pixel values, the selected resolution bandwidth, the detector and the level display mode (absolute or relative). To stabilize the noise power display, the R&S FSC uses the pixel on which the marker is positioned and the four pixels to the right and the four pixels to the left of the marker pixel. Noise power density can provide useful information when measurements are made on noise or digitally modulated signals. However, valid results are obtained only if the spectrum in the vicinity of the marker has a flat frequency response. The function gives incorrect results if measurements are made on discrete signals.

Operating sequence

➢ Press the MARKER key.

➢ Press the MARKER FUNCTION softkey.

➢ Select the NOISE menu item with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key or the MARKER FUNCTION softkey again.

   The R&S FSC now indicates the marker level in dBm/Hz. If a delta marker is the active marker, it displays the result in dBc/Hz. The result is referred to the marker 1.
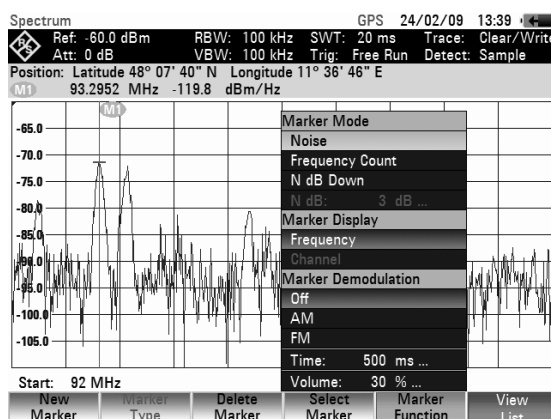
4.9.4.2   Measuring the Frequency

The FREQUENCY COUNT function is used to measure the frequency at the marker position. The accuracy of the marker frequency readout is then no longer dependent on the pixel resolution of the trace, but only on the accuracy of the internal reference frequency.

The R&S FSC calculates the marker frequency from the center frequency, the span and the frequency of the trace pixel on which the marker is positioned. The trace has 631 pixels corresponding to 631 frequency coordinates. The frequency resolution is therefore relatively coarse – especially if a large span is set. To circumvent this problem, the R&S FSC's internal frequency counter can be used. When you are performing frequency measurements, the R&S FSC briefly stops the sweep at the marker position and measures the frequency using the frequency counter. The resolution of the frequency counter is 0.1 Hz and so is considerably higher than the resolution that is obtained without the FREQUENCY COUNT function. Even though the resolution is high, frequency counting is extremely fast due to a special algorithm for the IQ baseband signal (approx. 30 ms at a resolution of 1 Hz). Basically, the accuracy of the frequency readout depends only on the accuracy of the internal reference frequency (TCXO).

The frequency counter only gives completely accurate readings for sine signals that are at least 20 dB above the noise floor. If the S/N ratio is less, noise affects the results.

Operating sequence

➢ Press the MARKER key.

➢ Press the MARKER FUNCTION softkey.

➢ Select the FREQUENCY COUNT menu item with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key or the MARKER FUNCTION softkey.

   The R&S FSC now displays the counted marker frequency with a resolution of 1 Hz. To indicate that the FREQUENCY COUNT function is on, the marker symbol changes from M1 to C.
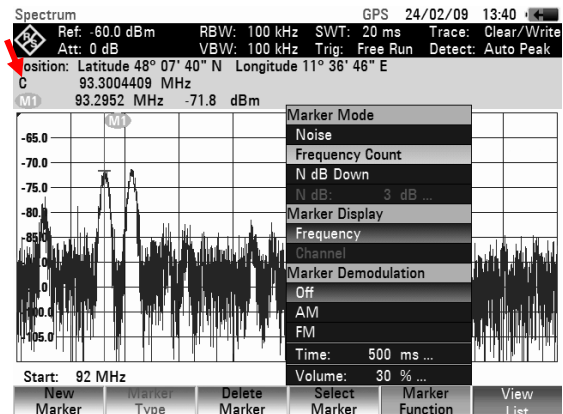
4.9.4.3   Measurement of the Signal Bandwidth

The N DB DOWN function is a way to measure a signal or the filter bandwidth.

Upon activation, two temporary markers are placed on the left and right of the active reference marker. In the measurement screen these are displayed as two vertical lines. The R&S FSC shows the bandwidth of the reference markers in a field above the measurement screen.

The distance to the reference marker is by default 3 dB below the reference marker. You can also adjust this value via the N DB: N DB... menu item. Entering a positive value sets the temporary markers below the reference marker. If it is, for any reason, not possible to calculate the frequency spacing, dashes are displayed instead of a value.

Upon entering a negative value, the function turns into a n dB up function. You can use a n dB up function, for example, for measurements on notch filters.

Operating sequence

➢ Press the MARKER key.

➢ Press the MARKER FUNCTION softkey.

➢ Select the N DB DOWN menu item with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key or the MARKER FUNCTION softkey.

   The R&S FSC displays two temporary markers on the left and on the right of the reference marker M1. It also shows the bandwidth of the n dB down markers (in this case 88.889 kHz).
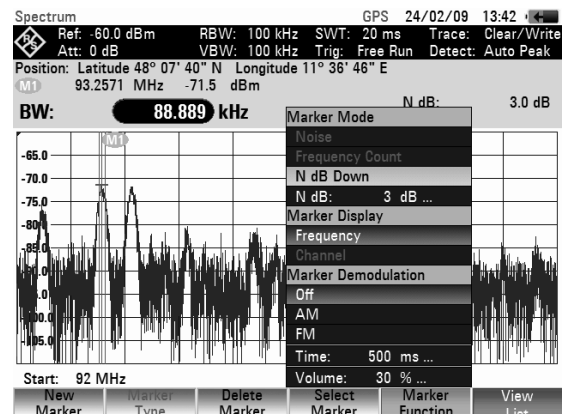
You can then adjust the distance of the temporary markers.

➢ Press the MARKER FUNCTION softkey.

➢ Select the N DB DOWN: N DB:... menu item with the rotary knob or the cursor keys.

   The R&S FSC opens a entry box to define a different dB value (in this case 9 dB).

➢ Confirm the entry with the ENTER key.

   The R&S FSC again shows the temporary markers, this time with a broader bandwidth (in this case 177.778 kHz).
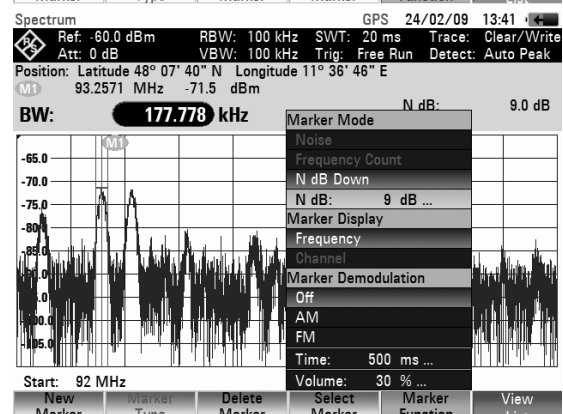
4.9.5   AF Demodulation

The R&S FSC has an AM and FM demodulator for audiomonitoring signals. The demodulated AF signal can be listened to with the internal speaker or headphones (optional accessories). The headphones are connected to the 3.5 mm jack on the top side of the instrument. As the R&S FSC makes the uncontrolled video voltage audible in the case of AM demodulation, it is advisable to set the reference level so that the level of the signal to be demodulated is near the reference level.

When spectrum measurements are being made, the R&S FSC demodulates the signal at the marker frequency for a settable period of time. The sweep stops at the marker frequency for the demodulation period and then continues. If time-domain measurements are being made (span = 0 Hz), the R&S FSC performs continuous demodulation.

Operating sequence:

➢ Press the MARKER key.

➢ Press the MARKER FUNCTION softkey.

The submenu for setting demodulation parameters opens. If no markers are active, the R&S FSC automatically activates a marker and positions it on the trace maximum.

➢ Select the demodulation scheme you want with the rotary knob or the cursor keys.

➢ Confirm your selection with the ENTER key.

Note:

When the AF demodulation mode is selected, the R&S FSC automatically turns off the noise marker or the frequency counter.
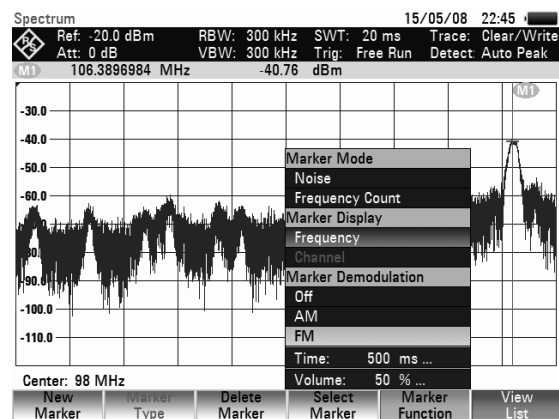
➢ To enter the demodulation time, select the TIME... item in the menu.

The currently set demodulation time is displayed in the value entry box. The demodulation time range is 100 ms to 500 s. If the R&S FSC is set to span = 0 Hz, the demodulation time setting is irrelevant as continuous demodulation is always performed.

➢ Change the time with the cursor keys or the rotary knob or enter a time using the number keys and confirm with the ENTER key.

➢ To adjust the volume, select the VOLUME... menu item and confirm your selection with the ENTER key.

The R&S FSC displays the volume in % in the value entry box. The volume range is 0 % (very low) to 100 % (full volume).

➢ Ajust the volume or enter the volume in % with the number keys, the rotary knob or the cursor keys.

➢ Confirm with the ENTER key.

4.10 Using the Display Line

In addition to the markers, the R&S FSC provides a horizontal line for determining the signal level in the display.

➢ Press the LINES key.

➢ Press the DISPLAY LINE softkey.

The R&S FSC displays a horizontal line across the entire diagram. The Y position of the line is indicated at the top left of the diagram (Line: -55 dBm in the diagram shown at the right).

➢ You can move the line with the rotary knob or the cursor keys in the Y direction. Alternatively, you can enter a level position with the number keys.

➢ Confirm the entry with the ENTER key.

The softkey label DISPLAY LINE turns green and the entry box closes.
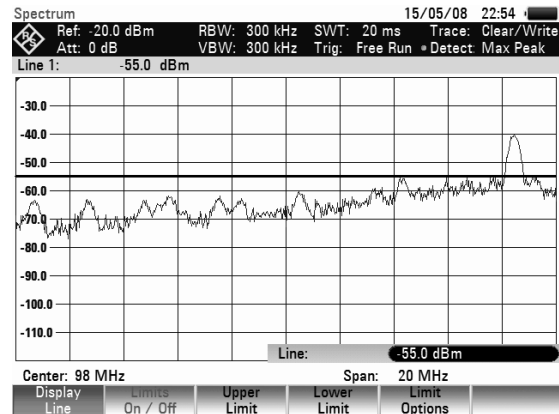
In contrast to the markers, the position of the display line is pixel-oriented. The line resolution in the Y direction therefore depends on the measurement range set in the Y direction. For a display range of 100 dB, it is 0.3 dB. If you set the line with the rotary knob, the R&S FSC always uses the step size of the display resolution in the Y direction, e.g. 0.3 dB for a 100 dB level measurement range. The cursor keys, on the other hand, always move the line by 10 % of the display range in the Y direction. For fast setting of the display line, we therefore recommend to set the line near the desired position with the cursor keys and then to use the rotary knob for fine adjustment.

4.11 Using Limit Lines

Limit lines set limits for level characteristics vs time or frequency on the display that must not be exceeded. For instance, the upper limits of permissible spurious or harmonics of a DUT are marked by limit lines. In the R&S FSC, you can preset the upper and lower limit value with the help of limit lines. Thus, a spectrum or level characteristic in the time domain (span = 0 Hz) can be checked either visually on the screen or automatically by verifying limit violations.

A limit line consists of at least two and at most 25 value pairs (points) on the x-axis (frequency, time or length) and the y-axis (level). The R&S FSC links the individual points by straight lines. The values on the x-axis may be specified in absolute units (e.g. frequency in MHz) or relative units referenced to the center of the measured trace (e.g. center frequency). Relative units are of advantage, for instance, when you want to measure modulated output signals. If the center frequency is varied, the mask on the screen remains unchanged. The points on the y-axis are always values in dB. If the scale on the y-axis is linear (unit V or W), the R&S FSC automatically switches to the respective dB unit after a limit line has been switched on.

You can create and edit limit lines with the R&S FSCView software and load them into the R&S FSC via the USB or the LAN interface. The number of limit lines the R&S FSC can store in its memory depends on the number of other data sets on the R&S FSC (see "Saving and Loading Instrument Settings and Measurement Results" in this manual).

Refer to the manual of the R&S FSCView software for information on how to create limit lines.

Operating sequence

➢ Press the LINES key.

The softkey menu for controlling limit lines opens.

The R&S FSC distinguishes between upper limit lines (UPPER LIMIT) and lower limit lines (LOWER LIMIT). In the case of upper limit lines, it checks if the results are above the limit. In case of lower limit lines, it checks if the result is below the line.
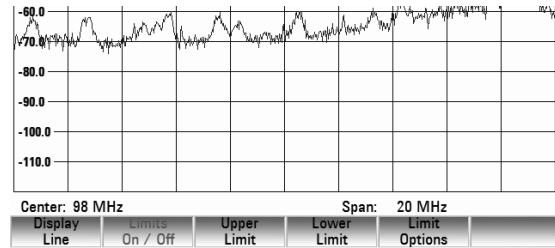
The preddefined limit lines already available with the R&S FSC can be used to mark both upper and lower limit values.

➢ Depending on the application, press the UPPER LIMIT or LOWER LIMIT softkey.

The R&S FSC displays a list of available limit lines. If no limit line is active, the R&S FSC by default marks the first value in the list. If no limit lines are available, the cursor will be placed on folder '\Public\.'.

The unit of the limit line and the unit currently set on the x-axis have to be identical. In order to determine the limit lines that are compatible to the current settings, you can filter the data sets accordingly:

➢ Press SORT/SHOW softkey.

➢ Select the SHOW COMPATIBLE menu item with the rotary knob or the cursor keys

➢ Confirm the selection with the ENTER key.
The R&S FSC displays those limit lines that are compatible to the current instrument settings.

In order to display all lines again

➢ Press SORT/SHOW softkey.

➢ Select the SHOW ALL menu item with the rotary knob or the cursor keys

➢ Confirm the selection with the ENTER key.

The file type indicates whether a data set contains a limit line with absolute frequency, time or length values (*.abslim) or values relative to the center of the x-axis (*.rellim).

Switching on a limit line

➢ Select the limit line you need from the list the rotary knob or the cursor keys.

➢ Confirm the selection with the SELECT softkey.

The R&S FSC returns to the limite lines menu and activates and displays the corresponding limit line. It also shows the name and type of the active limit line in a table above the result display.

➢ Press the EXIT softkey to exit the limit lines dialog box.
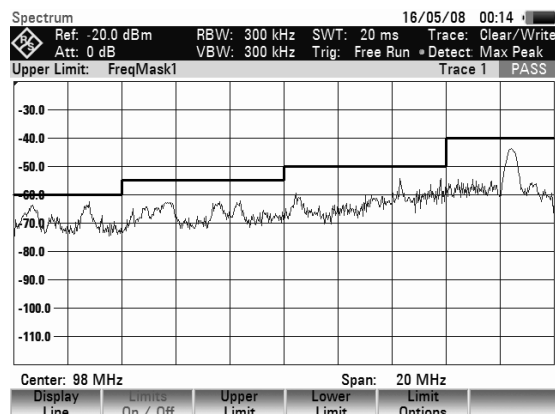
Switching off a limit line

➢ Press the LINES key.

➢ Press the UPPER LIMIT or LOWER LIMIT softkey.

➢ Select the DESELECT LIMIT menu item with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key.

➢ Alternatively, you can deactivate all active limit lines at the same time with the LIMITS ON/OFF softkey.

4.11.1 Measurements with Limit Lines

During a measurement, the R&S FSC checks the trace for upper and lower limit violations after each frequency sweep . As long as all measured values are within the limits, it displays PASS above the result display. If however, only a single value (or pixel of the trace) is outside the limits, the R&S FSC displays a FAIL notice in the table above the result display.

You can deactivate the automatic limit check at any time.

➢ Press the LIMITS ON/OFF softkey.

The R&S FSC deactivates all limit lines.

Activating the beeper

In addition to the PASS / FAIL messages on the screen, you can use an acoustic signal to indicate limit violations.

➢ Press the LIMIT OPTIONS softkey.

➢ Select the AUDIO BEEP menu item with the rotary knob or the cursor keys

➢ Confirm the selection with the ENTER key.

An [X] in front of the AUDIO BEEP menu item indicates that the beeper is active. If the audio beep is active, the R&S FSC outputs a beep each time a limit is violated.
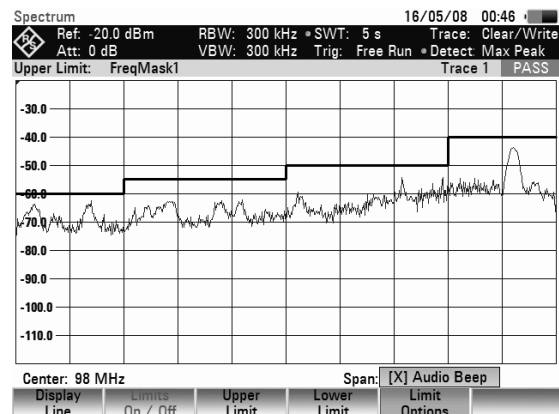
4.11.2 Definition Range of Limit Lines

If a limit line is not defined in the entire frequency range or displayed span, a check is not performed outside the definition range.

4.11.3 Data Sets Containing Limit Lines

The R&S FSC stores data sets together with any limit lines that may have been active for the measurement in question. When such a data set is recalled, the associated limit lines are available too. They do however not appear in the list of limit lines.

4.12   Performing Measurements

If you want to perform complex measurements, the R&S FSC provides measurement functions that perform certain measurement tasks with a minimum of keystrokes or, in conjunction with various accessories, will allow you to perform advanced measurements. These functions are collected under the MEAS key.

4.12.1   Measuring the Channel Power of Continuously Modulated Signals
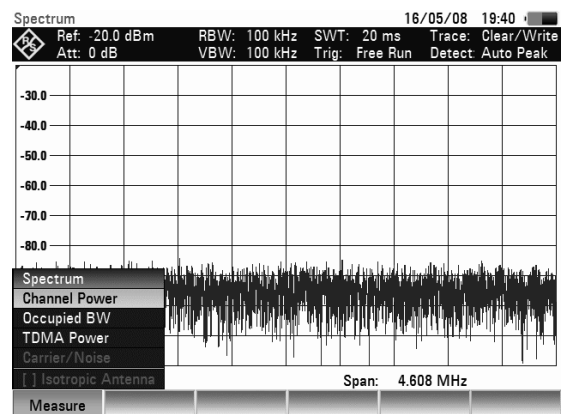
With the channel power measurement you can selectively measure the power of modulated signals. Unlike a power meter which measures power over its whole frequency range, the channel power measurement allows you to measure the power in a specific transmission channel. Other signals in the frequency spectrum have no effect on the result.

When measuring the channel power, the R&S FSC uses a resolution bandwidth that is small compared to the channel bandwidth to determine the spectrum of the channel. It then integrates the results on the trace to give the total power of the channel. The R&S FSC takes into account the selected display mode (absolute or relative), the selected detector and the resolution bandwidth. That means that you can compare the result to the result that would have been obtained from a thermal power meter. The small resolution bandwidth acts like a narrow channel filter and so prevents out-of-channel emissions from affecting the result.

The R&S FSC already comes with an assortment of predefined standards like 3GPP WCDMA, cdmaOne or CDMA2000 1x. You can, however, customize channel settings to set up the R&S FSC for other communication standards.

Operating sequence:

➢   Press the MEAS key.

➢   Press the MEASURE softkey.

The submenu for selecting the measurement functions opens.

➢   Select the CHANNEL POWER menu item with the rotary knob or the cursor keys.

➢   Confirm the selection with the ENTER key.

The R&S FSC starts the channel power measurement and displays the softkey menu of the channel power measurement.


Two vertical lines in the measurement diagram indicate the channel bandwidth. The measured channel power is shown in large letters below the measurement diagram.

The default setting is power measurement for 3GPP WCDMA signals.

Screen layout for channel power measurements:

① Standard

② Channel Bandwidth

③ Channel Power

④ Channel Bandwidth

⑤ Channel Power Menu
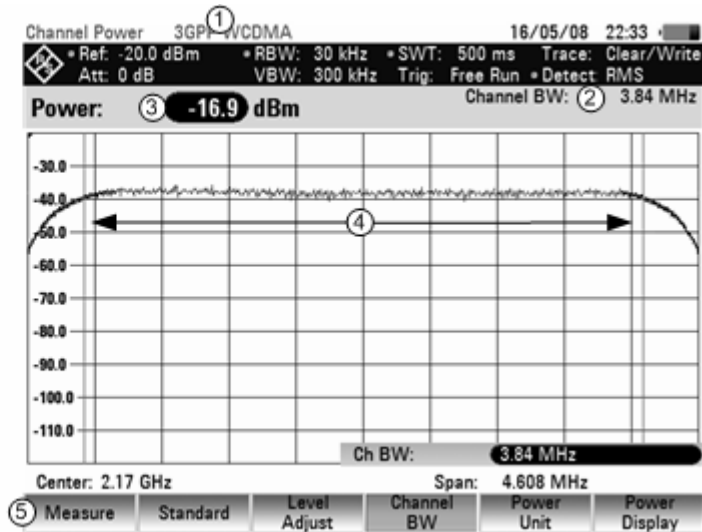
4.12.1.1   Selecting the Standard

The R&S FSC already comes with some predfeined standards that you can use for channel power measurements. However, you can create new configurations to perform measurements on other standards as well.

➢ Press the STANDARD softkey.

A dialog to select the standard opens.

➢ Select one of the available standards with the rotary knob or the cursor keys.

➢ Confirm the selection with the SELECT softkey.

The R&S FSC loads the configuration selected standard. It automatically sets the optimal span, resolution bandwidth, video bandwidth, sweep time and detector for the standard.

You can create and edit standards with the R&S FSCView software and load them into the R&S FSC via the USB or the LAN interface. The number of standards the R&S FSC can store in its memory depends on the number of other data sets on the R&S FSC (see "Saving and Loading Instrument Settings and Measurement Results" in this manual).

For more information on how to create and edit configurations refer to the R&S FSCView manual.

4.12.1.2   Setting the Reference Level

When selecting the reference level, make sure that you do not overload the R&S FSC.

As the power is measured with a small resolution bandwidth compared to the signal bandwidth, it is still possible to overload the R&S FSC, even if the trace is within the measurement diagram. To prevent an overload, perform the measurement with the largest resolution bandwidth possible using the peak detector. If you set these parameters, it is not possible for the trace to exceed the reference level..

To simplify operation and to prevent incorrect measurements, the R&S FSC has an automatic routine for setting the reference level.

➢ Press the AMPT key.

➢ Press the LEVEL ADJUST softkey.

The R&S FSC performs a measurement to determine the optimal reference level.

It uses a resolution bandwidth of 1 MHz, a video bandwidth of 1 MHz and the peak detector. After finishing the automatic measurement, the R&S FSC sets the optimal reference level.

4.12.1.3   Setting the Channel Bandwidth

The channel bandwidth specifies the frequency range around the center frequency, over which the R&S FSC performs the power measurement.

➢ Press the MEAS key.

➢ Press the CHAN BW softkey.

The Ch. BW value entry box opens.

➢ Enter the channel bandwidth you need with the number keys and confirm the entry with one of the unit keys or

➢ Enter the channel bandwidth with the rotary knob or the cursor keys and confirm the entry with the ENTER key.

The R&S FSC sets the appropriate span for the channel bandwidth that you have entered (span = 1.2 x channel bandwidth). This ensures that no incorrect channel power measurements are made.
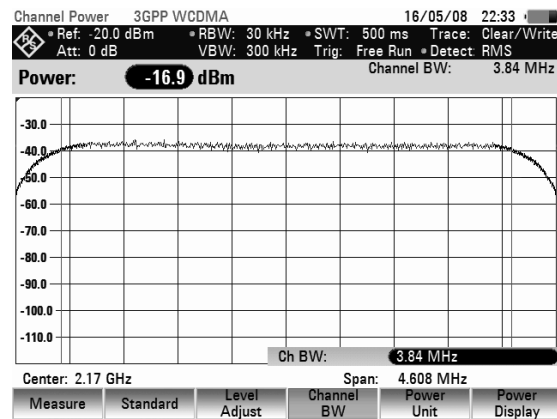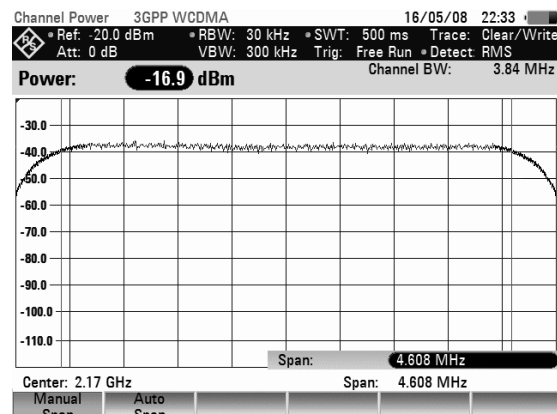
The minimum channel bandwidth that you can set is 833 Hz at a span of 1 kHz.

4.12.1.4   Changing the Span

Usually, the span the R&S FSC sets yields optimal results. But sometimes you also need to see the spectrum outside the current span to detect other signal components that you need to include in the measurement. Therefore, you can adjust the span to up to ten times the channel bandwidth and still be able to see the spectrum outside the measurement channel.

Operation sequence:

➢ Press the SPAN key.

The AUTO SPAN softkey is active and the optimum span for the channel power measurement is set.

➢ Press the MANUAL SPAN softkey.

The entry box to adjust the span opens.

➢ Enter the span you need with the number keys and confirm the entry with one of the unit keys, or

➢ Enter the span with the rotary knob or the cursor keys and confirm the entry with the ENTER key.

The largest possible span for the channel power measurement is ten times the channel bandwidth. At larger spans, the result of the channel power measurement would be increasingly imprecise, because too few points of the trace occur in the channel to be measured.

➢ Press the AUTO SPAN softkey to again set the optimum span.

Measurement of maximum channel power:

If signal levels fluctuate significantly, you can define the maximum channel power with the Max Hold function.

Operation sequence:

➢ Press the MEAS key.

➢ Press the POWER DISPLAY softkey.

➢ Select MAX HOLD with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key or the POWER DISPLAY softkey.

 The power display switches from "Power" to "Max Power".

➢ To deactivate the Max Hold function, press the POWER DISPLAY softkey.

➢ Select CLEAR/WRITE with the rotary knob or the cursor keys

➢ Confirm the selection with the ENTER key.

The power display switches from "Max Power" to "Power".
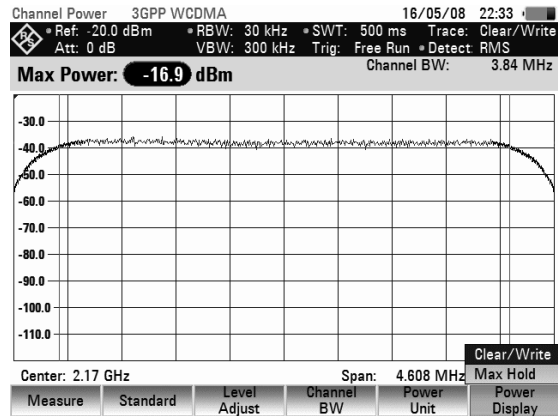
4.12.1.5   Unit for Power Display

The R&S FSC can apply different units to the power output. The default unit is dBm..

➢ Press the MEAS key.

➢ Press the POWER UNIT softkey.

The R&S FSC opens the submenu to select the unit.

➢ Select the unit you want with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key or the POWER UNIT softkey.

The R&S FSC displays the power level in the selected unit.
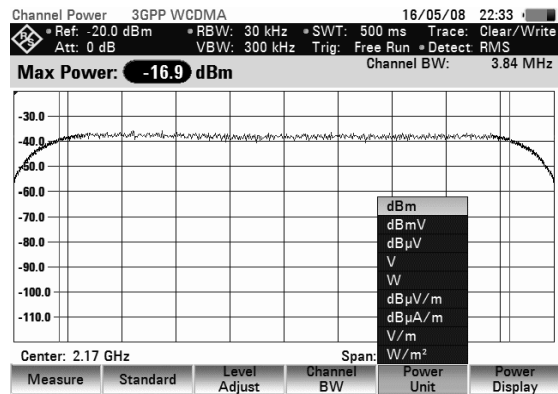
4.12.2   Measuring the Occupied Bandwidth

Proper operation of a transmission network requires that all transmitters adhere to the bandwidths assigned to them. The occupied bandwidth is defined as the bandwidth that contains a specified percentage of the entire power of the transmitter. In the R&S FSC, the power percent can be set between 10 % and 99.9 %. Numerous standards require a percent of 99 %. This is also the default setting of the R&S FSC.

After entering the channel bandwidth, the R&S FSC automatically selects the measurement parameters so that you can attain the best result.

Operation sequence:

➢ Press the MEAS key.

➢ Press the MEASURE softkey.

  The R&S FSC opens the measurement menu.

➢ Select the OCCUPIED BW menu item with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key or the MEASURE softkey.

  The R&S FSC starts the Occupied Bandwidth measurement and shows the corresponding softkey menu.
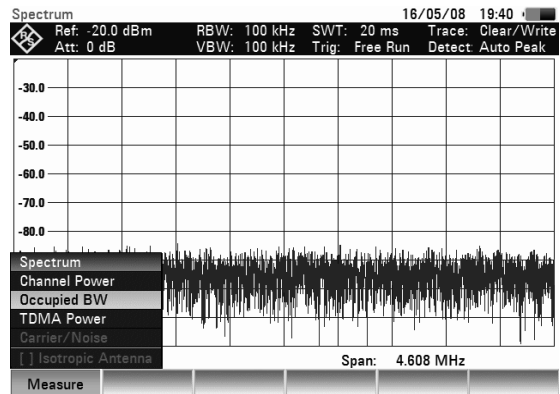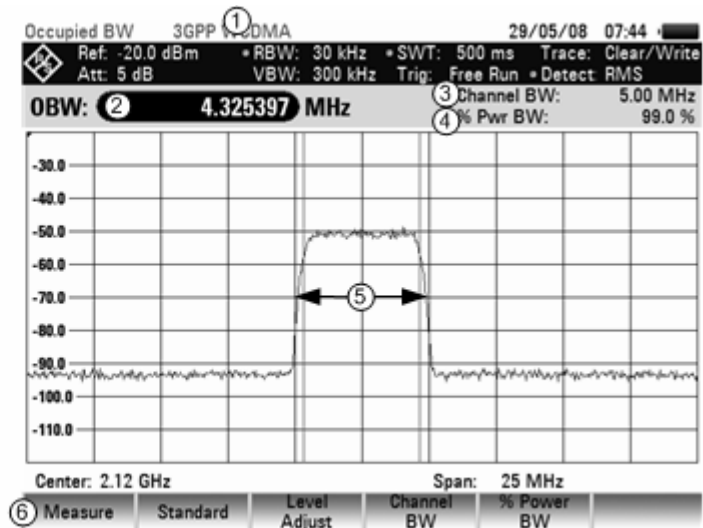
Two vertical lines in the measurement diagram indicate the occupied bandwidth. Above the trace window, you can see the numeric value (OBW) that was measured.

Screen layout for measuring the occupied bandwidth:

① Standard

② Occupied Bandwidth

③ Channel Bandwidth

④ Power Percentage

⑤ Occupied Bandwidth

⑥ OBW Menu

4.12.2.1 Selecting a Standard

The R&S FSC already comes with some predefined standards that you can use for measuring the occupied bandwidth. However, you can create new configurations to perform measurements on other standards as well.

➢ Press the STANDARD softkey.

  A dialog to select the standard opens.

➢ Select one of the available standards with the rotary knob or the cursor keys.

➢ Confirm the selection with the SELECT softkey.

  The R&S FSC loads the configuration selected standard. It automatically sets the optimal span, resolution bandwidth, video bandwidth, sweep time and detector for the standard.

You can create and edit standards with the R&S FSCView software and load them into the R&S FSC via the USB or the LAN interface. The number of standards the R&S FSC can store in its memory depends on the number of other data sets on the R&S FSC (see "Saving and Loading Instrument Settings and Measurement Results" in this manual).

For more information on how to create and edit configurations refer to the R&S FSCView manual.

If you change the settings or create datasets, note that

- the span is always coupled to the channel bandwidth (CHANNEL BW). Changes to either of those automatically adjust the other (= 5 x channel bandwidth).

- the resolution bandwidth should be between 1% and 4% of the channel bandwidth. This ensures that the occupied bandwidth is measured with high accuracy.

- the video bandwidth must be at least three times the resolution bandwidth. This prevents incorrect results due to the compression of signal peaks by the video filter.

- the RMS detector is recommended. This ensures that the power measurement is always correct irrespective of the waveform being investigated.

- the sweep time must be set so that the result is stable. If you increase the sweep time, the R&S FSC also increases the integration time for the RMS detector and thus ensures more stable measured values.

4.12.2.2   Setting the Reference Level

When selecting the reference level, make sure that you do not overload the R&S FSC.

As the power is measured with a small resolution bandwidth compared to the signal bandwidth, it is still possible to overload the R&S FSC, even if the trace is within the measurement diagram. To prevent an overload, perform the measurement with the largest resolution bandwidth possible using the peak detector. If you set these parameters, it is not possible for the trace to exceed the reference level.

To simplify operation and to prevent incorrect measurements, the R&S FSC has an automatic routine for setting the reference level.

➢ Press the AMPT key.

➢ Press the LEVEL ADJUST softkey.

The R&S FSC performs a measurement to determine the optimal reference level.


It uses a resolution bandwidth of 1 MHz, a video bandwidth of 1 MHz and the peak detector. After finishing the automatic measurement, the R&S FSC sets the optimal reference level.

4.12.2.3   Setting the Channel Bandwidth

The channel bandwidth determines the span and therefore the resolution bandwidth and sweep time the R&S FSC uses for measuring the occupied bandwidth.

➢ Press the MEAS key.

➢ Press the CHAN BW softkey.

   The Ch. BW value entry box opens.

➢ Enter the channel bandwidth you need with the number keys and confirm the entry with one of the unit keys or

➢ Enter the channel bandwidth with the rotary knob or the cursor keys and confirm the entry with the ENTER key.

   The R&S FSC sets the appropiate span for the channel bandwidth you have entered (span = 5 x channel bandwidth) This ensures that no incorrect channel power measurements are made.
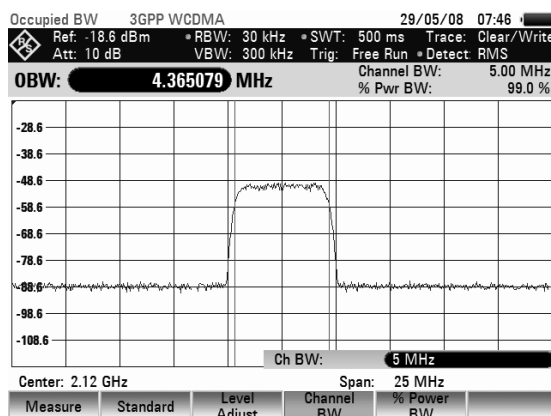
The minimum channel bandwidth that you can set is 2 kHz. If you attempt to enter a smaller channel bandwidth, the R&S FSC will automatically set 2 kHz.

4.12.2.4   Entering the Power Percent to Determine the Occupied Bandwidth

➢ Press the MEAS key.

➢ Press the % POWER BW softkey.

   The R&S FSC opens the % Pow BW entry box.

   In this box, you can define the power percent relative to the total span power that defines the occupied bandwidth (percent of total power).

➢ Enter the percentage you need with thenumber keys, the rotary knob or the cursor keys.

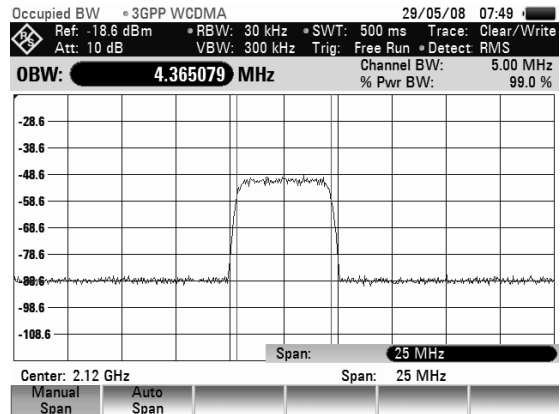➢ Confirm the entry with the ENTER key or the % POWER BW softkey.
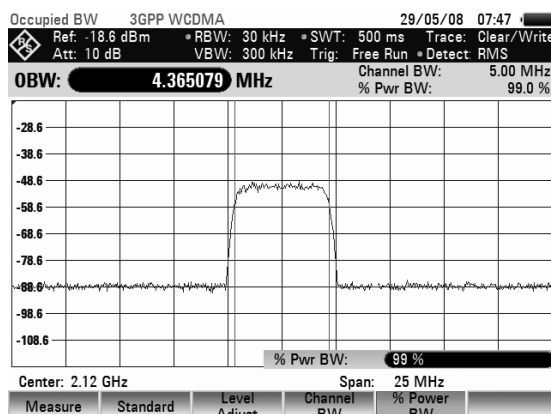
The R&S FSC now displays the occupied bandwidth graphically in the trace window and numerically above the trace window.

4.12.2.5   Changing the Span

Usually, the span the R&S FSC sets yields optimal results. But sometimes you also need to see the spectrum outside the current span to detect other signal components that you need to include in the measurement. Therefore, you can adjust the span to up to ten times the channel bandwidth and still be able to see the spectrum outside the measurement channel.

Operation sequence:

➢ Press the SPAN key.

The AUTO SPAN softkey is active and the optimum span for the channel power measurement is set.

➢ Press the MANUAL SPAN softkey.

The entry box to adjust the span opens.

➢ Enter the span you need with the number keys and confirm the entry with one of the unit keys, or

➢ Enter the span with the rotary knob or the cursor keys and confirm the entry with the ENTER key.

The largest permissible span for measuring the occupied bandwidth is ten times the channel bandwidth. At larger spans, the result of the channel power measurement would be increasingly imprecise, because too few points of the trace occur in the channel to be measured.

➢ Press the AUTO SPAN softkey to again set the optimum span.

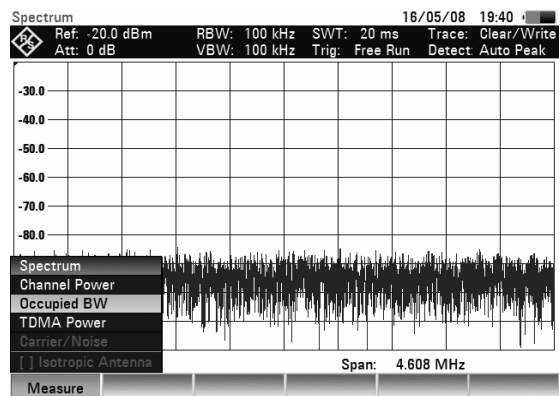## 4.12.3   Power Measurements on TDMA Signals

When TDMA (time division multiple access) methods are used, e.g. for GSM, several users share a channel. Each user is assigned a period of time or timeslot. With the TDMA POWER measurement, you can determine the power over one of the timeslots.

The TDMA power measurement is a measurement in the time domain (span = 0 Hz). You can start it on an external or video trigger and specify the power measurement time.

To prevent incorrect power measurements in the time domain, make suree that the whole signal is within the selected resolution bandwidth. If the resolution bandwidth is too small, the displayed power will be lower than the actual power.

Operation sequence:

➢ Press the MEAS key.

➢ Press the MEASURE softkey.

The R&S FSC opens the measurement menu.

➢ Select the TDMA POWER menu item with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key or the MEASURE softkey.

The R&S FSC starts the TDMA power measurement and shows the corresponding softkey menu.

Screen Layout for power measurements on TDMA signals:

① Standard

② Power Readout

③ Measurement Limits

④ Trigger Level

⑤ Measurement Time

⑥ TDMA Power Menu
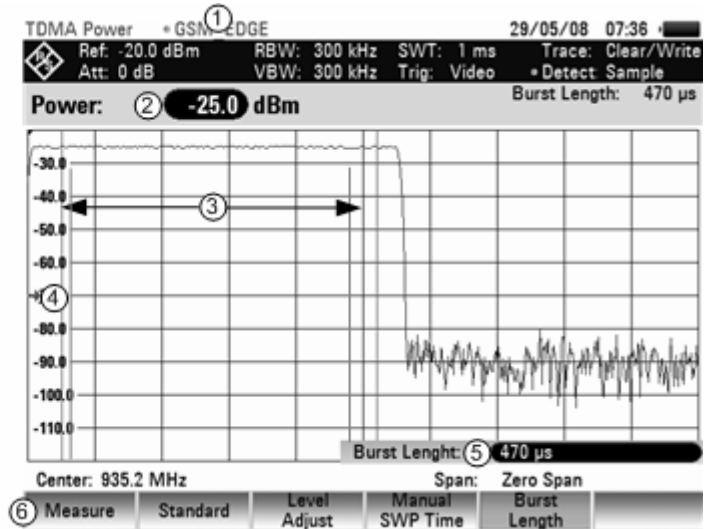
## 4.12.3.1 Selecting a Standard

On activating the measurement, the R&S FSC automatically selects the GSM/EDGE standard. All default settings are selected so that power measurements on GSM or EDGE bursts give true readings.

You can create and edit standards with the R&S FSCView software and load them into the R&S FSC via the USB or the LAN interface. The number of standards the R&S FSC can store in its memory depends on the number of other data sets on the R&S FSC (see "Saving and Loading Instrument Settings and Measurement Results" in this manual).

For more information on how to create and edit configurations refer to the R&S FSCView manual.

4.12.3.2 Setting the Burst Length

The burst length is the measurement time over which the R&S FSC performs a power measurement. You can select a value less than or equal to the sweep time.

➢ Press the BURST LENGTH softkey.

   The value entry box to specify the burst length opens.

➢ Enter the time you need with the number keys and confirm the entry with one of the unit keys or

➢ Enter the time you need with the rotary knob or the cursor keys and confirm the entry with the ENTER key.

   The R&S FSC performs the measurement over the time you have entered.
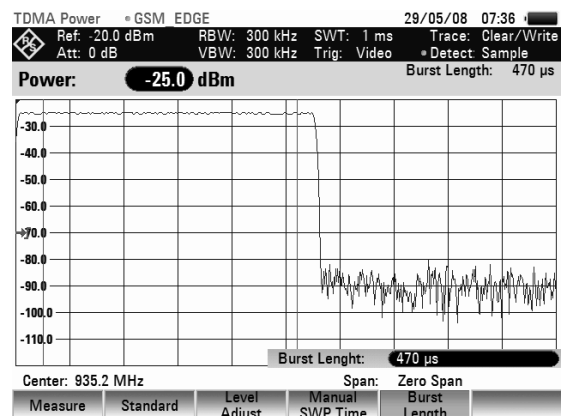
If the measurement time you have entered was greater than the sweep time, the R&S FSC sets a burst length equal to the sweep time. To work with a greater burst length, you have to increase the sweep time first.

The minimum burst length is the time corresponding to one trace pixel (= sweep time / 631).
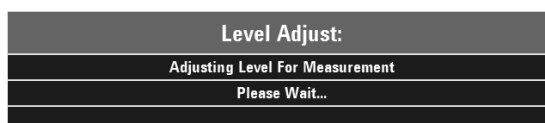
4.12.3.3   Setting the Reference Level

When selecting the reference level, make sure that you do not overload the R&S FSC if the signal's power is stronger than the maximum reference level.

Because the R&S FSC's resolution bandwidths are implemented digitally after the A/D converter, the signal level at the A/D converter can be higher than the level indicated by the trace, depending on the selected resolution bandwidth.

To prevent the A/D converter from being overloaded, the signal must be measured at the widest resolution bandwidth and video bandwidth with the peak detector. The trace maximum then determines the best reference level.

To simplify operation and to prevent incorrect measurements, the R&S FSC has an automatic routine for setting the reference level.

➢ Press the AMPT key.

➢ Press the LEVEL ADJUST softkey.

> The R&S FSC performs a measurement to determine the optimal reference level.

Level Adjust:
Adjusting Level For Measurement
Please Wait...

> It uses a resolution bandwidth of 3 MHz, a video bandwidth of 3 MHz and the peak detector. After finishing the automatic measurement, the R&S FSC sets the optimal reference level.

4.12.3.4   Power Readout

The R&S FSC displays the measured power and the selected burst length above the trace window (Power = nn.nn dBm).

4.12.3.5   Setting the Trigger

A trigger is usually required to perform power measurements on bursts. In the default setting, the R&S FSC is configured to use the video trigger at 50 % of the Y scale on the measurement diagram. Assuming that the burst on which the measurement is to be made crosses the 50 % point of the trigger, the R&S FSC will trigger on the rising edge of the burst.

Should this not be the case, you have to adjust the trigger level so that the R&S FSC is triggered by the burst edge. Otherwise no measurement will be performed.

If the DUT has a trigger facility, the external trigger can also be used for the measurement.

➢ Connect the DUT's trigger output to the R&S FSC's trigger input.

➢ Press the SWEEP key.

➢ Press the TRIGGER softkey.

➢ Select the EXTERNAL RISE or EXTERNAL FALL menu item (rising or falling edge) with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key or the TRIGGER softkey.
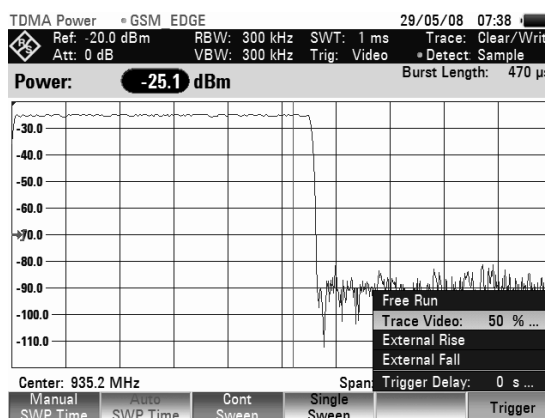
Select the appropriate trigger delay to position the burst in the measurement window.

➢ Press the TRIGGER softkey.

➢ Select the TRIGGER DELAY menu item with the rotary knob and confirm with the ENTER key

➢ Enter the trigger delay with the number keys and confirm the entry with one of the unit keys or

Enter the trigger delay with the rotary knob or the cursor keys until the TDMA burst is inside the vertical lines that indicate the measurement range and confirm the entry with the ENTER key.

4.12.4   Measuring the Adjacent Channel Leakage Ratio (ACLR)

The Adjacent Channel Leakage Ratio (ACLR) measurement is a method to measure the power over more than one transmission channel and also evaluate the power of the adjacent (or alternate) channels of the transmission channel. The ACLR performs measurements according to a specific channel configuration, e.g. a particular radio communications standard.

Starting the Measurement:

➢ Press the MEAS key.

➢ Press the MEAS MODE softkey.

    The submenu for selecting the measurement functions opens.

➢ Select the ACLR menu item with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key or the MEASURE softkey.

In principle, the ACLR measurement works like the Channel Power measurement in that it determines the spectrum within the channel using a resolution bandwidth that is small compared to the channel bandwidth. In addition to the channel bandwidth, the ACLR measurement is also defined by the channel spacing, the bandwidth of adjacent channels and the adjacent channel spacing. The R&S FSC offers measurements on up to 12 carrier channels and 12 adjacent channels to either side of the carrier. When measuring more than one carrier or adjacent channels, the R&S FSC shows the powers of each channel in a list below the marker list. The channel itself is marked by red (transmission channels) or green (adjacent channels) vertical lines.

Screen Layout for Adjacent Channel Power measurements:

① Standard
② Marker Information
③ Channel Information
④ TX Channel (red line)
⑤ Adj Channel green line)
⑥ Alt Channel (green line)
⑦ Marker (blue line)
⑧ ACP Menu

The predefined standards are the same as for Channel Power measurements (3GPP WCDMA, cdmaOne and CDMA2000 1x systems). However, you can also customize the settings to set up the R&S FSC for other radio communication standards. You can define the settings directly on the R&S FSC or define and manage them using the R&S FSCView software.

When customizing settings, make sure to consider the following points to get valid and accurate measurement results:

• Reference Level

    Make sure not to overload the R&S FSC as the power is measured with a resolution bandwidth that is small in comparison with the signal bandwidth. As with Channel Power measurements, use the ADJUST LEVEL softkey to automatically set the reference level to an optimal level.

- Setting the Span:

  The frequency span must at least cover the carriers and the adjacent channels plus a measurement margin of about 10% to get valid results.

If the frequency span is too large in comparison to the channel bandwidth (or the adjacent-channel bandwidths) being examined, only a few points on the trace are available per channel. This reduces the accuracy of the waveform calculation for the channel filter used, which has a negative effect on the measurement accuracy. It is therefore strongly recommended that the formulas mentioned be taken into consideration when selecting the frequency span.

If the span is automatically calculated by the R&S FSC with the AUTO SPAN softkey, the span is calculated as follows:

(No. of transmission channels - 1) x transmission channel spacing + 2 x transmission channel bandwidth + measurement margin

with the measurement margin being approx. 10% of the value obtained by adding the channel spacing and the channel bandwidth.

- Setting the Resolution Bandwidth:

  The RBW should not be too high or too small to get both an acceptable measurement speed and a suppression of spectral components outside the channels. As a rule of thumb, it is recommended to set it to about 1% to 4% of the channel bandwidth.

  You can select a larger resolution bandwidth if the spectrum within the channel to be measured and around it has a flat characteristic. In the standard setting, e.g. for standard cdmaOne at an adjacent channel bandwidth of 30 kHz, a resolution bandwidth of 30 kHz is used. This yields correct results since the spectrum in the neighborhood of the adjacent channels normally has a constant level. For standard NADC/IS136 this would not be not possible, for example, since the spectrum of the transmit signal penetrates into the adjacent channels and a too large resolution bandwidth causes a too low selection of the channel filter. The adjacent-channel power would thus be measured too high.

  If the RBW is automatically calculated by the R&S FSC with the AUTO RBW softkey, the RBW is calculated as follows:

  RBW ≤ 1/40 of channel bandwidth

  The R&S FSC then selects the maximum possible resolution bandwidth resulting from the available RBW steps (1, 3) is selected.

- Setting the Video Bandwidth

  To obtain correct power measurements, the video signal must not be limited in bandwidth. A restricted bandwidth of the logarithmic video signal would cause signal averaging and thus result in a too low indication of the power (-2.51 dB at very low video bandwidths). Therefore, the VBW should be at least three times the RBW.

  If the RBW is automatically calculated by the R&S FSC with the AUTO VBW softkey, the RBW is calculated as follows:

  VBW ≥ 3 x RBW

  The R&S FSC then selects the smallest possible VBW with regard to the available step size will be selected.

- Selecting the Detector:

  It is best to use the RMS detector. This detector correctly indicates the power irrespective of the characteristics of the signal to be measured. The whole IF envelope is used to calculate the power for each measurement point. The IF envelope is digitized using a sampling frequency which is at least five times the resolution bandwidth which has been selected. Based on the sample values, the power is calculated for each measurement point using the following formula:

$$P_{RMS} = \sqrt{\frac{1}{N} \sum_{i=1}^{N} s_i^2}$$

with
s_i = linear digitized video voltage at the output of the A/D converter
N = number of A/D converter values per measurement point
PRMS = power represented by a measurement point

When the power has been calculated, the power units are converted into decibels and the value is displayed as a measurement point.

In principle, the sample detector would be possible as well. Due to the limited number of measurement points used to calculate the power in the channel, the sample detector would yield less stable results.

4.12.4.1 Selecting the Standard

The R&S FSC already comes with some predefined standards that you can use for measuring the ACLR. However, you can create new configurations to perform measurements on other standards as well.

Loading Predefined Standards

The R&S FSC already comes with several predefined standards when it is shipped. It is also possoble to create a new standard and permanently store it on the R&S FSC via the R&S FSCView software.

➢ Press the STANDARD softkey.

   A dialog box with all available standards opens.

➢ Select the standard you want using the rotary knob or the cursor keys.

➢ Confirm your selection with the ENTER key or the STANDARD softkey.

   The R&S FSC sets the selected standard. The optimal span, resolution bandwidth, video bandwidth, sweep time and detector for the standard are selected automatically.

**Creating Standards with the R&S FSCView software**

You can create and edit standards with the R&S FSCView software and load them into the R&S FSC via the USB or the LAN interface. The number of standards the R&S FSC can store in its memory depends on the number of other data sets on the R&S FSC (see "Saving and Loading Instrument Settings and Measurement Results" in this manual).

For more information on how to create and edit configurations refer to the R&S FSCView manual.

4.12.4.2 Configuring the Measurement

Setting the Number of Channels

➢ Press the CHANNEL SETTINGS softkey.

➢ Select the TX CHANNELS menu item with the rotary knob or the cursor keys.

The entry box to set the number of channels opens.
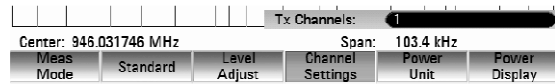
➢ Enter the number of transmission channels you need with the number keys.

➢ Confirm the entry with the ENTER key.

➢ Press the CHANNEL SETTINGS softkey.

➢ Select the ADJ CHANNELS menu item with the cursor keys or the rotary knob.

The entry box to set the number of adjacent channels opens.
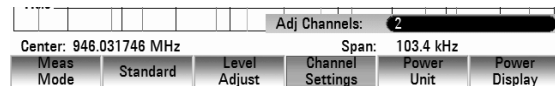
➢ Enter the number of adjacent / alternate channels you need and confirm the input with the ENTER key.

The borders of Tx channels are displayed red in the trace diagram, the borders of adjacent and alternate channels are displayed green.

Setting the Channel Bandwidth

The channel bandwidth specifies the frequency range about the center frequency, over which the R&S FSC performs the power measurement.

➢ Press the CHANNEL BW softkey.

The R&S FSC opens a dialog box to define the channel bandwidths for all channels.

➢ Select the channel you want to change the bandwidth for with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key.

You can now edit the channel spacing.

➢ Enter the channel bandwidth you need with the number keys and confirm the entry with the appropriate unit, or

➢ Enter the channel bandwidth you need with the rotary knob or the cursor keys and confirm the entry with the ENTER key.

The R&S FSC automatically sets the appropriate span for the channel bandwidth according to the criteria described above to ensure that no incorrect channel power measurements are made.

Setting the Channel Spacing

In case of the R&S FSC, the channel spacing is defined as the distance between the center frequency of the transmission channel and the center frequency to the next transmission channel or the distance between the center frequency of the transmission channel and the center frequency of the adjacent channel.

> Note that some some radio communication standards, e.g. CDMA2000 DS / MC1 / MC3 and IS95 B / C, IS97 B / C, IS98 B / C, define the channel spacing differently, namely the distance from the center of the transmission channel to the closest border of the adjacent channel. The R&S FSC does not consider these specifics. It always regards the channel spacing as the distance between the center of a channel and the center of its neighboring channel.

➢ Press the CHANNEL SETTINGS softkey.

➢ Select the CHANNEL SPACING menu item with the rotary knob or the cursor keys.

   The R&S FSC opens a dialog box to define the spacings for all transmission channels and adjacent / alternate channels.

➢ Select the channel you want to change the spacing for with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key.

   You can now edit the channel spacing.

TX / ACP Channel Spacing	
TX1-2	20 kHz
TX2-3	20 kHz
TX3-4	20 kHz
TX4-5	20 kHz
TX5-6	20 kHz
TX6-7	20 kHz
TX7-8	20 kHz
TX8-9	20 kHz
TX9-10	20 kHz
TX10-11	20 kHz
TX11-12	20 kHz
Adj	20 kHz
Alt1	20 kHz
Alt2	20 kHz
Alt3	20 kHz
Alt4	20 kHz

➢ Enter the spacing you need with the number keys and confirm the entry with the appropiate unit or

➢ Enter the spacing you need with the rotary knob or the cursor keys and confirm the entry with the ENTER key.

➢ Press the EXIT softkey to exit the dialog box.

   The R&S FSC now takes the new values into account for future measurements.

When performing measurements on multi-carrier signals, you can define the spacing of the transmission (Tx) channels to one another. By default, the R&S FSC assumes equal spacing between all Tx channels in the system. Therefore, the spacing you enter for the first two Tx channels is automatically applied to all other Tx channels.

If you do measurements on systems with a different channel spacing for each Tx channel, you can also set the channel spacing for each Tx channel separately by entering the respective number in the fields.

If the spacings are not equal, the channel distribution according to the center frequency is as follows:

- Odd number of TX channels

   The middle TX channel is centered to center frequency.

- Even number of TX channels

   The two TX channels in the middle are used to calculate the frequency between those two channels. This frequency is aligned to the center frequency.

Adjacent or alternate channel spacing is also available for single-carrier measurements. The R&S FSC can perform measurements on up to 12 adjacent channels. Usually the first adjacent channel to the Tx channel is referred to as the Adjacent Channel (ADJ). All others are called Alternate Channels (ALT1 to ALT11).

By default, the R&S FSC assumes that the distance of the adjacent channels to each other is the same. In that case, you only have to enter the first spacing value. The R&S FSC then calculates all higher adjacent channels from that value. If you change the spacing of one of the higher channels, the R&S FSC only updates the channel spacings above the one you have changed, but not those below.

So, for example, if you set the first adjacent channel spacing (ADJ) to 20 kHz, the following spacings are 40 kHz (ALT1), 60 kHz (ALT2), 80 kHz (ALT3), 100 kHz (ALT4), 120 kHz (ALT5) and so on.

If you then change the spacing of the third alternate channel (ALT3) to 100 kHz, the R&S FSC adjusts the alternate channels above the third one accordingly: 125 kHz (ALT4), 150 kHz (ALT5) and so on.

Normalization of Measurement Results

By default, the power of the channels and adjacent channels is displayed in the unit dBm. It is also possible to display the power density of the signal to, for example, measure the signal/noise power density or obtain the signal to noise ratio.

➢ Press the CHANNEL SETTINGS softkey.

Select the CHANNEL PWR/HZ menu item to activate normalization.

The R&S FSC switches the unit from dBm to dBm/Hz.

The channel power density in dBm/Hz corresponds to the power inside a bandwidth of 1 Hz and is calculated as follows:

channel power density = channel power - $\log_{10}$(channel bandwidth)

**Displaying Absolute and Relative Results**

You can set up the result display to either show the absolute power of the adjacent channels or the power relative to one of the transmission channels.

➢ Press the POWER DISPLAY softkey.

Select either the ABSOLUTE menu item to display the absolute results or the RELATIVE menu item to display the power relative to one of the transmission channels.

Selecting the Reference Channel

When determining relative power values for the adjacent channels, you can set a specific transmission channel as the reference channel.

➢ Press the CHANNEL SETTINGS softkey.

➢ Select the ACLR REF SETTING menu item with the rotary knob or the cursor keys.
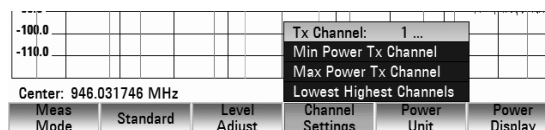
The R&S FSC opens a another submenu to select the reference channel.

➢ Select the method of determining the reference channel using the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key.

The following methods are available:

- TX CHANNEL:
  Select a specific transmission channel by entering its number as the reference.

- MIN POWER TX CHANNEL:
  The channel with the lowest power level is the reference channel.

- MAX POWER TX CHANNEL
  The channel with the highest power level is the reference channel.

- LOWEST HIGHEST CHANNEL

The outer left-hand transmission channel is the reference channel for the lower adjacent channels. The outer right-hand transmission channel is the reference channel for the upper adjacent channels.

Setting and Checking the Limits

Limit checks in ACLR measurement mode are independent of limit line handling. You can define a limit for each of the adjacent channels. Limits for adjacent channels can be set either in absolute or relative terms.

Defining relative limits

➢ Press the CHANNEL SETTINGS softkey.

➢ Select the CHANNEL LIMIT RELATIVE menu item

➢ Confirm the selection with the ENTER key.

   The R&S FSC opens a dialog box to define the relative limits for each adjacent channel.

➢ Select the input field of an adjacent or alternate channel with the rotary knob or the cursor keys and active the field with the ENTER key.

➢ Select the channel you want to check with the SELECT softkey.

   The channel turns green and the check box in the first column is marked.

➢ Enter the limit value you need with the number keys.

➢ Confirm the entry with the ENTER key.

   The R&S FSC automatically activates the check flag, so that the limit is included in future limit checks.
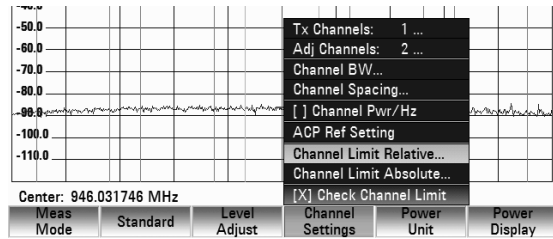
To deactivate the limit check for a specific channel, move the cursor to the channel in question with the rotary knob or the cursor keys and deselect it with the SELECT softkey.

Defining absolute limits

➢ Press the CHANNEL SETTINGS softkey.

➢ Select the CHANNEL LIMIT ABSOLUTE menu item.

➢ Confirm the selection with the ENTER key.

   The R&S FSC opens a dialog box to define the absolute limits for each adjacent or alternate channel.

➢ The procedure of defining absolute limits is analogous to that of defining relative limits.

Performing a limit check

➢ Press the CHANNEL SETTINGS softkey.

➢ Select the CHECK CHANNEL LIMITS menu item with the rotary knob or the cursor keys and confirm the selection with the ENTER key.

   The R&S FSC automatically performs limit checks. The results of the limit check are displayed in the table above the trace. If a result fails the limit check, it turns red and has a star (*) in front of its power level.
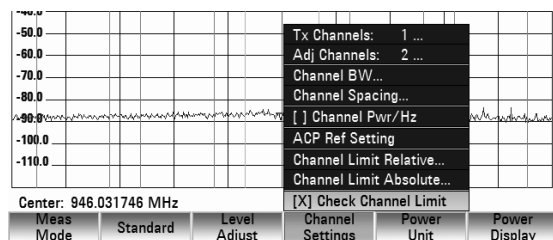
4.12.5   Measuring the Spectrum Emission Mask

The Spectrum Emission Mask (SEM) measurement is a method to detect spurious emissions or intermodulation products of a signal. When performing a SEM measurement, the R&S FSC checks the signal against a spectral mask to see whether the signal is in compliance to a specific standard or not. Therefore, the R&S FSC provides predefined Spectrum Emission Masks for various telecomunications standards.

However, you can define your own spectral masks with the R&S FSCView software to perform measurements in frequency ranges other than the predefined. To learn how to define Spectrum Emission Masks, refer to the FSCView manual.

Starting the Measurement:

➢   Press the MEAS key.

➢   Press the MEAS MODE softkey.

   The submenu for selecting the measurement functions opens.

➢   Select the SPECTRUM EMISSION MASK menu item with the rotary knob or the cursor keys.

➢   Confirm the selection with the ENTER key or the MEAS MODE softkey.

Note that the frequency range of the actual measurement depends on the start and stop frequency you have set on the R&S FSC. Correct measurement results are therefore only possible if the frequency ranges of the SEM are inside the current span of the R&S FSC.

Screen Layout for the Spectrum Emission Mask measurement

① Standard
② Marker Information
③ SEM List
④ Limit Check Result
⑤ Spectrum Emission Mask (red line)
⑥ Trace (yellow line)
⑦ Marker (blue line)
⑧ SEM Menu

4.12.5.1   Selecting a standard

Several predefined standards are already installed on the R&S FSC to use for Spectrum Emission Mask measurements. It is also possible to customize settings or create new standards using the R&S FSCView software.

Loading Predefined Standards

The R&S FSC already comes with several predefined standards when it is shipped. All predefined standards are in accordance to the standard specifications. It is also possible to create a new standard and permanently store it on the R&S FSC via the R&S FSCView software.

➢ Press the STANDARD softkey.

   A dialog box with all available standards opens.

➢ Select the standard you want with the rotary knob
   or the cursor keys.

➢ Confirm the selection with the ENTER key or the
   STANDARD softkey.

   The R&S FSC sets the selected standard. The
   optimal span, resolution bandwidth, video
   bandwidth, sweep time and detector for the
   standard are selected automatically.

Creating Standards with the R&S FSCView software

You can create and edit standards with the R&S FSCView software and load them into the R&S FSC
via the USB or the LAN interface. The number of standards the R&S FSC can store in its memory
depends on the number of other data sets on the R&S FSC (see "Saving and Loading Instrument
Settings and Measurement Results" in this manual).

For more information on how to create and edit configurations refer to the R&S FSCView manual.

4.12.5.2   Optimizing measurement settings

After selecting the standard and applying the signal to the R&S FSC, you can optimize measurement
settings to avoid overloading the R&S FSC.

➢ Press the ADJUST SETTINGS softkey.

   The R&S FSC adjusts the reference level and the span

4.12.5.3   Viewing the results in a table

You can add a table to the display that shows the measurement results in numerical form.

➢ Press the VIEW LIST softkey.

   The R&S FSC shows a list above the trace
   diagram. If the list contains more than four entries,
   you can scroll through the list with the rotary knob
   or the cursor keys to see the other results. Note
   that scrolling works only if there is no active input
   field.

The list contains the following information:

- Tx Power

  Power level of the transmission channel.

- Tx Bandwidth

  Bandwidth of the transmission channel.

- PASS / FAIL information

  If the signal is within the limits of the spectral mask, the R&S FSC shows PASS, if not it shows
  FAIL.

- Range [Hz]

  Frequency range. The first number is the start frequency, the second number the stop frequency of each defined frequency range. The character following the number indicates the unit (k = kHz, M = MHz, G = GHz)

- RBW [Hz]

  Resolution bandwidth the corresponding frequency range is measured with.

- Freq [Hz]

- Power Abs

  Absolute peak power in the corresponding frequency range.

- Power Rel

  Relative peak power in relation to the channel power of the reference channel.

- Δ Limit

  Minimum distance from the limit line to the trace in the corresponding frequency range. Negative values or a zero indicate a passed SEM limit check, positive values indicate a violation of the limit check.
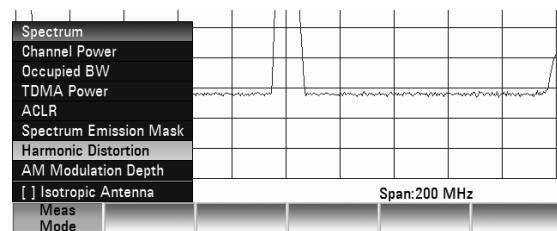
4.12.6   Measuring the Harmonic Distortion

The Harmonic Distortion measurement is an easy way to identify the harmonics of a DUT. In addition to the graphic display of the harmonics, this measurement mode also calculates the Total Harmonic Distortion (THD) and shows the results.

You can perform a Harmonic Distortion measurement in frequency sweep (span > 0) and zero span mode (span = 0). When starting the measurement, the R&S FSC looks for the first harmonic of the signal (= the highest signal) in the defined frequency range. It then adjusts the frequency axis so that all harmonics are visible. In zero span mode, the center frequency remains the same.

Starting the measurement:

➢ Press the MEAS key.

➢ Press the MEAS MODE softkey.

  The submenu for selecting the measurement functions opens.

➢ Select the HARMONIC DISTORTION menu item with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key or the MEAS MODE softkey.

  The search for harmonics starts as soon as you enter the Harmonic Distortion measurement. Upon entering the measurement, the R&S FSC automatically adjusts the settings in order to display the selected number of harmonics (default = 2) on the screen.

Screen layout for determining the Harmonic Distortion

① Harmonics List
② Total Harmonic Distortion in %
③ Total Harmonic Distortion in dB
④ Trace
⑤ Markers (indicating harmonics)
⑥ Harmonic Distortion Menu

Defining the number of harmonics

By default, the R&S FSC shows the signal and its first harmonic. Each harmonic is indicated by a marker that the R&S FSC places on the harmonic (here M1 and M2). Note that all of the markers that have been set are normal markers that show the absolute frequency of the harmonic.

At the same time, the R&S FSC also calculates the values for the total harmonic distortion (THD) and shows the results in a box above the trace diagram. The values are output in % as well as dB,

If you want to see more than one harmonic, the R&S FSC can show up to six harmonics.
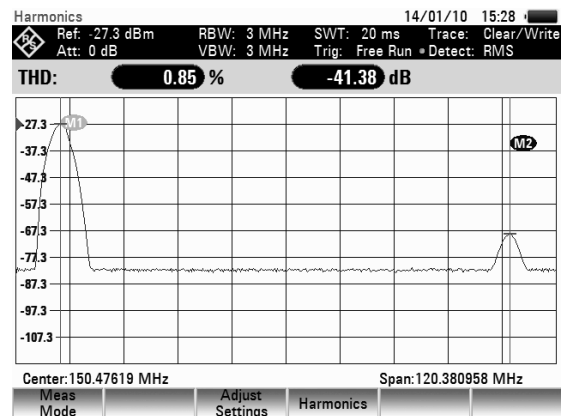
➤ Press the HARMONICS softkey.

➤ Enter the number of harmonics you'd like to see in the input field.

➤ Confirm the entry with the ENTER key or the HARMONICS softkey.

The R&S FSC places the markers on the other harmonics even if they are outside of the display range.

➤ Press the ADJUST SETTINGS softkey.

The R&S FSC adjusts the reference level, center frequency and span in a way that all harmonics are visible in the diagram area.
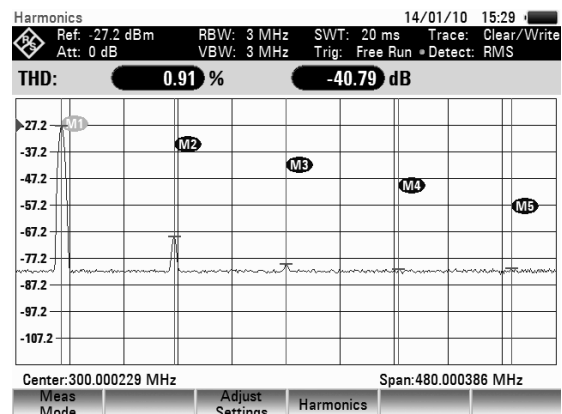
Activating the harmonics list
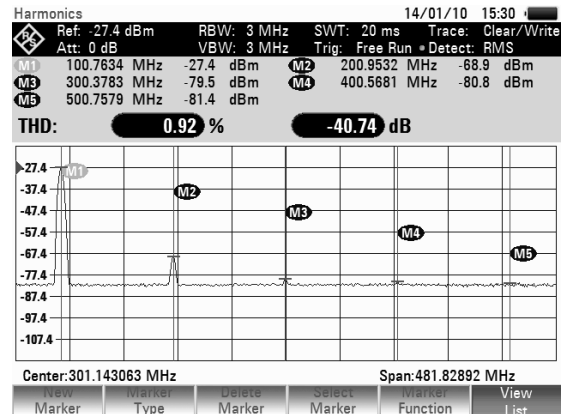
To see the exact frequency of the harmonic, you can activate the marker list that shows the value for each marker.

➢ Press the MKR key.

➢ Press the VIEW LIST softkey.

The R&S FSC displays the marker list that contains the values for each harmonic.

4.12.7 Measuring the AM Modulation Depth

The AM Modulation Depth measurement analyzes AM modulated signals and calculates the modulation depth of the signal using the measurement results. Note that the measurement works properly only if you apply an AM modulated signal.

Starting the measurement:

➢ Press the MEAS key.

➢ Press the MEAS MODE softkey.

The submenu for selecting the measurement functions opens.

➢ Select the AM MODULATION DEPTH menu item with the rotary knob or the cursor keys.

➢ Confirm your selection with the ENTER key or the MEAS MODE softkey.
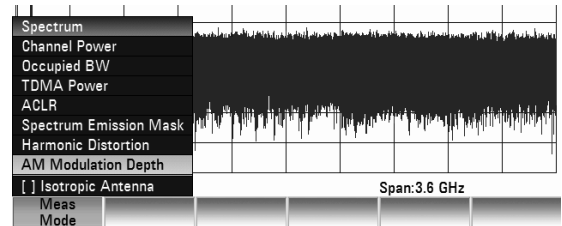
After you have started the measurement, the R&S FSC places three markers on the trace. The first marker is placed on the peak power level. The R&S FSC assumes that position as the level of the carrier. The second and third markers are delta markers. These are placed symmetrically on the adjacent peak values to the left and right of the carrier.

By default, delta marker 2 is active for editing. If you move the delta marker to another position, the other delta marker will be moved by the same distance relative to the normal marker. Note that this happens only if you move delta marker 2 (D2). When moving delta marker 3 (D3), only this marker is repositioned.

From the values of the markers, the R&S FSC then calculates the AM modulation depth. The AM modulation depth is the ratio between the power values at the reference marker and at the delta markers. When the powers of the two AM side bands are not the same, the R&S FSC uses the mean value of the two sideband values.

**Screen layout for the AM Modulation Depth measurement**
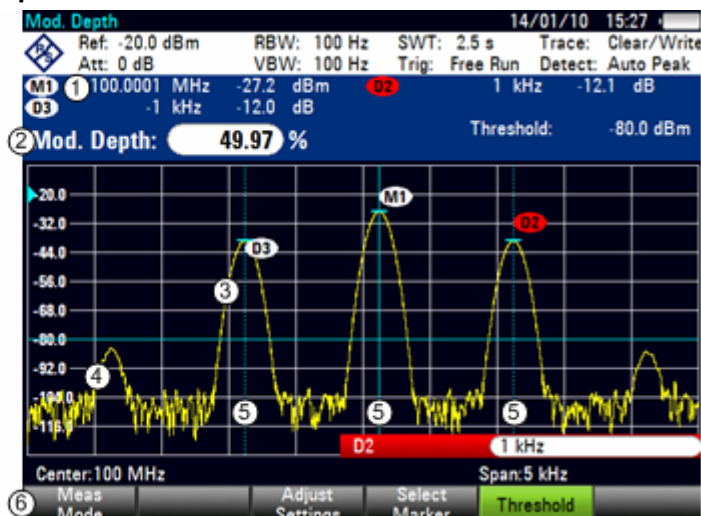
① Marker List
② Modulation Depth
③ Trace
④ Threshold Line
⑤ Markers
⑥ AM Mod Depth Menu

Setting a threshold

You can set a threshold that defines the minimum power level the signal must have. If the power of the signal is below the threshold, the R&S FSC will not set the markers and therefore will not calculate the modulation depth.

➢ Press the THRESHOLD softkey

A dialog box opens.

➢ Enter the threshold value you need and confirm it with the ENTER key.

The threshold is represented as a horizontal blue line in the diagram area.
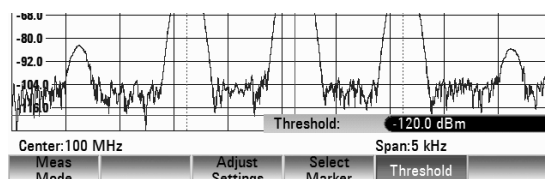
Optimizing the settings

In order to get the best results, you can use the automatic adjustment routine that the R&S FSC offers.

➢ Press the ADJUST SETTINGS softkey.

The R&S FSC performs a sweep and repeats the peak search sequence for the three markers.
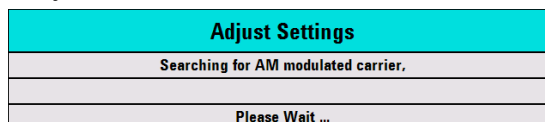
Activating the marker list

To see the exact frequency of the carrier and its sidebands, you can activate the marker list that shows the value for each marker.

➢ Press the MKR key.

➢ Press the VIEW LIST softkey.

The R&S FSC displays the marker list that contains the values for carrier and sideband.

4.13   Two-port Measurements with the Tracking Generator

Only for R&S FSC with tracking generator (order number 1314.3006.13, 1314.3006.16).

The R&S FSC can be supplied with an optional tracking generator to measure the transmission of two-ports or the reflection coefficients of one-ports and two-ports. The tracking generator outputs a signal at the current R&S FSC frequency. The nominal output level can be selected from 0 dBm to -50 dBm in 1 dB steps.

Two-port transmission can be determined directly by connecting the input of the DUT to the output of the tracking generator and the DUT's output to the R&S FSC's RF input.

➢   Press the MODE key.

➢   Press the NETWORK ANALYZER softkey.

The R&S FSC turns on the tracking generator and switches to its softkey menu. However, the frequency and level settings from the spectrum analyzer mode are not changed.

The softkey menu for the network analysis includes the softkey for calibrating the measurement. Calibration is necessary because the tracking generator output level does not exactly match the values specified in the table and it is frequency-dependent.

When performing the normalization, a single reference measurement is made at the corresponding port or between both ports. By means of this reference measurement, for example, the frequency response of a connected measurement cable can be compensated accurately enough.

If transmission measurements are performed on a two-port, the calibration takes the transmission characteristics of the test setup and the frequency response of the tracking generator into account and corrects the measurement with the correction data that has been obtained.

Screen layout for two-port measurements with tracking generator:

① Result Display
② Measurement Mode
③ Status Line
   - S-Matrix
   - Calibration Status
   - Measurement Format
④ Trace Window
⑤ Softkey Menu

When the tracking generator is switched on, the status line indicates (Uncal). This indicates that tracking generator measurements are uncalibrated. The level axis is in the relative unit dB. Apart from the level values, the 0 dB reference is also displayed. This corresponds to a reference level of 0 dBm in the spectrum analyzer mode (= nominal output level of the tracking generator).

When the tracking generator is on, measurement parameters like bandwidth or the frequency range are selected with the appropriate keys as in the spectrum analyzer mode. When the MEAS key is pressed, the softkey menu for the tracking generator is displayed.

Before calibration, the output level of the tracking generator, the frequency range you want and the appropriate reference level should be set because calibration is only valid for the calibrated frequency range and reference. Changing these parameters after calibration invalidates calibration.

> The calibration remains valid if the start frequency, stop frequency, center frequency and span are subsequently changed within the calibrated frequency range. In this case, the R&S FSC interpolates the correction data between the reference points of the calibration. The R&S FSC retains the calibration values but displays (Interp) in the status line to indicate a possible increase in measurement uncertainty.

> In spectrum analysis mode, port 1 is used as the RF input.

Setting the output level:

➢ Press the AMPT key.

➢ Press the TG OUTPUT ATTENUATION softkey.

  The input field to set the output level opens.
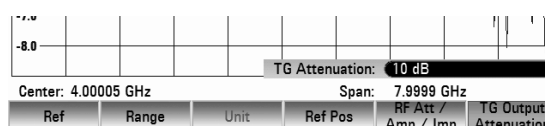
  You set the output level by selecting an attenuation value (0 dB to 40 dB). If you select 0 dB, the output level will be 0 dBm. If you select 40 dB, the output level will be –40 dBm.

➢ Set the attenuation level you need with the number keys, the rotary knob or the cursor keys.

➢ Confirm the entry with the ENTER key.

4.13.1   Measuring the Transmission of Two-Port DUTs

To perform a transmission measurement, connect the input of the DUT to the generator output and the DUT's output to the RF input of the R&S FSC. The R&S FSC measures the magnitude of the DUT's transmission.

The measurements of the operating sequences below are performed on a two-port filter with a center frequency of 2060 MHz and a bandwidth of approx. 11 MHz. The measurement example starts with the R&S FSC in its default setting.

Setting the frequency range:

➢ Press the PRESET key.

➢ Press the MODE key.

➢ Press the NETWORK ANALYZER softkey.

  The R&S FSC displays the tracking generator menu. As calibration has not yet been performed, the R&S FSC displays (uncal) in the status line.

➢ Press the FREQ key.

  The frequency menu and the input field to set the center frequency open.

➢ Enter the center frequency of 2060 MHz with the number keys.

➢ Confirm the entry with the unit keys.

  The R&S FSC now sets a center frequency of 2060 MHz.

➢ Press the SPAN key.

  The span menu and the input field to define the span open.

➢ Enter the span of 50 MHz with the number keys.

➢ Confirm the entry with the unit keys.

 The R&S FSC is now set up to perform the measurements on the filter.

4.13.1.1 Scalar Transmission Measurement

➢ Press the MEAS key.

➢ Press the MEAS MODE softkey.

➢ Select the SCALAR menu item with the rotary knob or the cursor keys

➢ Confirm the selection with the ENTER key or the MEAS MODE softkey.
The R&S FSC is now ready to perform scalar transmission measurements.
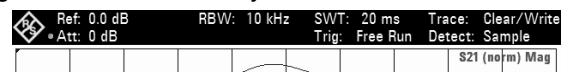
Calibrating the measurement

➢ Press the CALIBRATE softkey.

➢ Select the NORMALIZE TRANSMISSION FWD (PORT1⇨2) menu item with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key or the CALIBRATE softkey.

To perform the calibration, the R&S FSC asks you to connect its RF input to the tracking generator output.
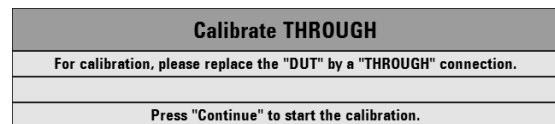

➢ Connect the RF input of the R&S FSC directly to the tracking generator output without the DUT.

➢ Press the CONTINUE softkey to start the calibration.

➢ You can abort the calibration at any time by pressing the CANCEL softkey.

After it has finished the calibration routine, the R&S FSC shows the message **Calibration done!** for a short time. The status line now says (Cal).

➢ Connect the DUT between the RF input and the generator's output.

The R&S FSC displays the transmission magnitude. You can now look for exact measurement results with, for example, markers.
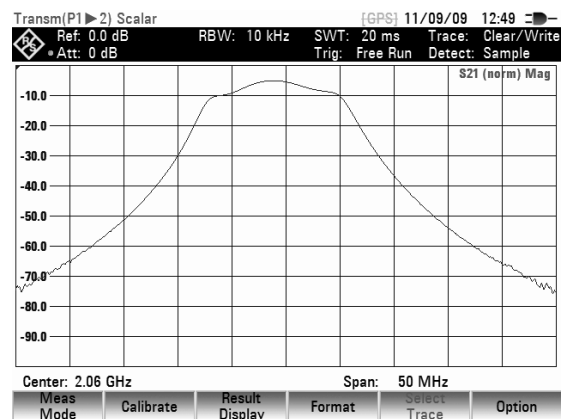
The calibration for transmission measurements remains valid until you change the center frequency or the span to such an extent that the new span falls outside the calibrated frequency range. The status line again says (Uncal) if the calibration is no longer valid.

If you change the reference is changed after the calibration, you must anticipate greater measurement uncertainty. The R&S FSC retains the calibration data but displays (Interp) in the status line to indicate a possible increase in measurement uncertainty (< 0.3 dB).

Changing any other of the parameters like bandwidth, detector, sweep time or measurement range has no effect on measurement accuracy. You can therefore change these parameters after the calibration without reducing the accuracy of the results.

You can save calibration data like other data sets after you have performed the calibration. That means that you can simply load the data set containing the calibration data and then perform measurements without calibrating the R&S FSC first.

Measurement on amplifiers

With measurements on amplifiers, the reference must be shifted so that the amplifier's transmission function can be seen on the screen. An increase of the reference level corresponds to an increase of the input attenuation. The R&S FSC provides a reference setting for this purpose. The position of the 0 dB reference can be shifted to positive or negative values.
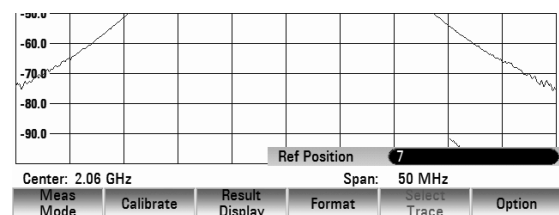
➢ Press the AMPT key.

➢ Press the REF LEVEL softkey.

➢ Set the reference with the number keys, the rotary knob or the cursor keys.

➢ Confirm the entry with the ENTER key or the REF LEVEL softkey.
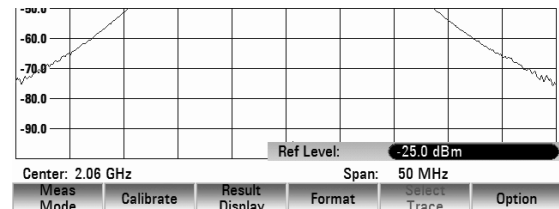
When performing measurements on amplifiers, make sure not to overload the R&S FSC. The risk of an overload is eliminated as long as the trace is within the display area on the screen (with REF POSITION = 10 dB).

You can also shift the reference without increasing the input attenuation – for example, in order to move the trace to the center of the screen. You can do this with the REFPOS function. The values 0 to 10 indicate the horizontal lines from bottom to top (with 0 = bottom line, 10 = uppermost line). The value 5 indicates the line in the center of the diagram.

➢ Press the AMPT key.

➢ Press the REFPOS softkey.

➢ Set the reference position with the number keys, the rotary knob or the cursor keys.

➢ Confirm the entry with the ENTER key or the REFPOS softkey.

4.13.1.2   Measuring the Transmission Magnitude

After you have selected the result display, you can view different aspects of the results. The number of available measurement formats depends on the measurement mode and result display you have selected previously.

➢ Connect the DUT between the tracking generator output and the RF input.

You can now adjust the reference position for better viewing results.

➢ Press the AMPT key

➢ Press the REF POS softkey

➢ Set the reference position with the number keys, the rotary knob or the cursor keys.

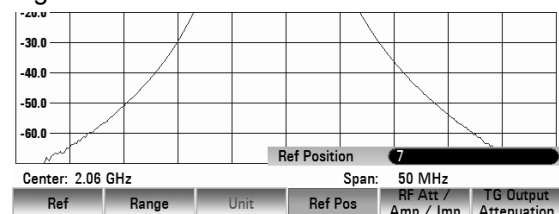➢ Confirm the selection with the ENTER key or the REFPOS softkey.

4.13.2   Working with Channel Tables in Network Analyzer Mode

The R&S FSC allows you to use channel tables in Network Analyzer mode.

➢   Press the FREQ key.

➢   Press the CHANNEL TABLE softkey.
    The R&S FSC opens the list of channel tables loaded into the R&S FSC via R&S FSCView.

➢   Select the desired channel table with the rotary knob or the cursor keys and switch it on with the SELECT softkey.
    The R&S FSC scans the channel table for the channels with the lowest and highest frequencies and sets those as the start and stop frequency.

You can define channel tables using the R&S FSCView software and load them into the spectrum analyzer. The R&S FSC can store more than 100 different channel tables that can be activated from the front panel as required. The maximum number of channel tables may be reduced if transducer factors, cable models, limit values or data sets are stored simultaneously (see "Saving and Loading Instrument Settings and Measurement Results" in this manual).

Refer to the manual of the R&S FSCView software for information on how to create channel tables.

4.13.3   Using Limit Lines in Network Analyzer Mode

When working with the magnitude format in the network analyzer, you can use limit lines to set limits for level characteristics on the display that must not be exceeded.

You can create and edit limit lines with the R&S FSCView software and load them into the R&S FSC via the USB or the LAN interface. The number of limit lines the R&S FSC can store in its memory depends on the number of other data sets on the R&S FSC (see "Saving and Loading Instrument Settings and Measurement Results" in this manual).

For information on how to work with limit lines, see

•   Using Limit Lines on page 48

4.14   Using Power Sensor

For highly accurate power measurements, you can connect one of the power sensors that are available for the R&S FSC. The R&S FSC provides a USB port to connect the power sensors on its front.

You can use the following power sensors with the R&S FSC.

- R&S NRP-Z11
- R&S NRP-Z21
- R&S NRP-Z22
- R&S NRP-Z23
- R&S NRP-Z24
- R&S NRP-Z31
- R&S NRP-Z51
- R&S NRP-Z55
- R&S NRP-Z56
- R&S NRP-Z57
- R&S NRP-Z81
- R&S NRP-Z91
- R&S NRP-Z92

In addition to the power sensor you need a passive USB adapter (R&S NRP-Z4) to connect the power sensor to the R&S FSC.

For more information on the characteristics of the supported power sensors see

- the datasheet of the R&S FSC
- the website for R&S power sensors.

4.14.1   Connecting the Power Sensor

The R&S FSC controls and powers the power sensors via the USB interface. Connect the power sensor cable to the R&S FSC's USB interface. You can then connect the DUT to the N-connector of the power sensor.

NOTICE

Risk of damage to the power sensor

Before you start to work with the power sensor, make sure that the continuous power applied to input of the power sensor does not exceed a certain level.

Refer to the documentation of the power sensor for more information on the maximum input power.

4.14.2   Performing Measurements

➢   Press the MODE key.

➢   Press the POWER METER softkey

    The R&S FSC activates the mode for power measurements.

    If the R&S FSC recognizes a power sensor, it sets up a connection via the interface and after a few
    seconds shows the measured power.

    If no power sensor has been connected or is not connected appropiatly, the R&S FSC shows
    nothing.

    If there are communication problems between the R&S FSC and the power sensor, the R&S FSC
    displays one of the following error messages that indicate the possible cause.

Message	Cause	Remedy
Warning: Input overloaded	The power at the input of the power sensor exceeds the permitted power (23 dBm = 200 mW).	Reduce the power at the sensor input.
Power sensor hardware error	Communication error between the R&S FSC and the power sensor.	Unscrew the sensor from the R&S FSC and check the connectors. If the problem persists, contact a Rohde & Schwarz service center.

Screen layout for power-sensor measurements:

① Connected power sensor
② Reference value
③ Reference Offset
④ Measurement time
⑤ Numeric measurement result
⑥ Graphic measurement result
⑦ Softkey Menu

The power sensor has a memory containing frequency-dependent correction values. Therefore the
highest accuracy is reached for signals whose frequency is known.

Note that if the R&S FSC switches over to the power measurement mode from another operating mode,
it uses the center frequency set in that mode as the frequency for the power sensor.

If you want to perform measurements on another known signal, the power sensor can be "told" what the
center frequency is via the frequency entry mode (FREQ softkey).

➢   Press the FREQ softkey.

The frequency value entry box opens.

➢   Enter the frequency you want with the number
    keys.

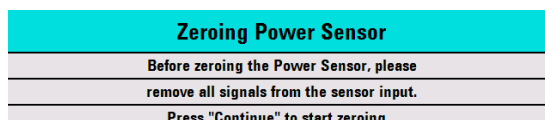➢   Confirm the entry with one of the unit keys.

The R&S FSC transfers the new frequency to the power sensor which then corrects the measured power readings.

Zeroing the Power Sensor

Offset voltages and currents have most effect on the power readout when low powers are being measured. Zeroing is used to compensate for these offsets. The power sensor zeroes itself automatically when instructed to do so.

Do not apply power during the zeroing process, as the power sensor cannot distinguish between external powers and internal offsets.

➢ Press the ZERO softkey.

 The R&S FSC asks you not to apply any signals to the power sensor during the zeroing process.

Zeroing Power Sensor
Before zeroing the Power Sensor, please
remove all signals from the sensor input.
Press "Continue" to start zeroing...

➢ Disconnect the power sensor from any signal sources.

➢ Press the CONTINUE softkey to start zeroing..

➢ Press CANCEL to abort zeroing (for example if you cannot disconnect the signal source.

The R&S FSC immediately starts power sensor zeroing. While zeroing is in progress, the R&S FSC shows the message "Zeroing power sensor, please wait..".


Zeroing Power Sensor

Please Wait...
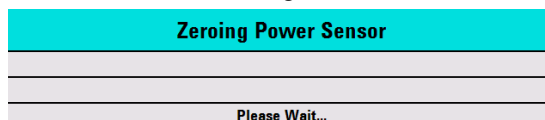
When zeroing is over, the R&S FSC shows the message **Power Sensor Zero OK!** and switches back to the softkey menu for the power sensor.

Selecting the Unit for the Power Readout

The R&S FSC can display measured power in relative units (dBm) or in absolute units (W, mW, µW, nW and pW). A reference level in dB is also provided by the R&S FSC.

➢ Press the UNIT softkey.

 A submenu to select the unit opens.

➢ Select the unit you want with the rotary knob or the cursor keys.
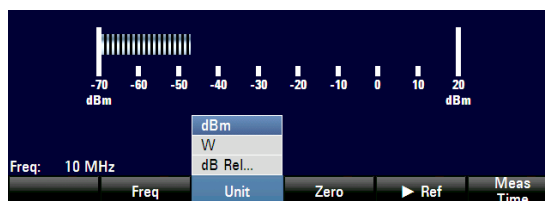
➢ Confirm the selection with the ENTER key or the UNIT softkey.

Setting the Reference Level

If you have selected the unit dB Rel, the R&S FSC opens an input field to set the reference level.

➢ Enter the reference level with the number keys.

➢ Confirm the entry with one of the unit keys.

Alternatively, you can set the current level reading as the reference level.

➢ Press the ▶REF softkey.

 The R&S FSC opens an input field.

➢ Enter the reference value you want.

 The R&S FSC adjusts the reference level to the currently measured power level.
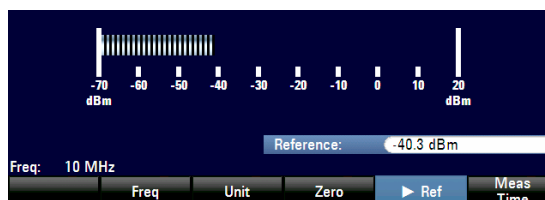
 It then displays the measured level relative to the reference level in dB. The unit is automatically set to dB Rel...

 The R&S FSC shows the currently set reference level in the diagram header.

Setting the Averaging Time

The averaging time determines for how long the signal will be measured. The longer the averaging time, the more stable the display, particularly if signals are at the lower end of the measurement range or are noisy. You can perform "Short", "Normal" or "Long" averaging.

Stationary sine signals with a high level (> -40 dBm) require only a short measurement time to produce stable, accurate results. "Short" averaging is recommended to obtain a high repetition rate for the measurement. Use "Normal" averaging to increase the stability of the display for signals with low levels or for modulated signals. The "Long" mode is recommended for signals with very low power levels (<-50 dBm to <-60 dBm).

➢ Press the MEAS TIME softkey.

➢ Select the measurement time you want to use with the rotary knob or the cursor keys.

➢ Confirm the selection with the ENTER key or the MEAS TIME softkey.

Taking Additional Loss or Gain into Account

At high powers that cause the power sensor maximum input level to be exceeded or at very low levels that are below the R&S FSC minimum sensitivity, the R&S FSC can take additional loss or gain between the DUT and the power sensor into account. These are defined in terms of an offset in dB relative to the measured level. A positive offset corresponds to a loss and a negative offset to a gain.

➢ Press the AMPT key.

➢ Press the REF OFFSET softkey.
The value entry box for the reference offset opens.

➢ Enter the required offset with the number keys, the rotary knob or the cursor keys
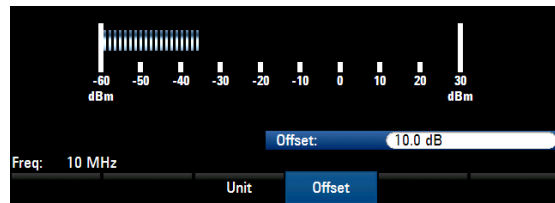
➢ Confirm the entry with the ENTER key or the REF OFFSET softkey.

The offset is taken into account in the power or level display.

The R&S FSC shows the current offset in the diagram header.

4.15   Measuring with Transducer Factors

The frequency-dependent transducer factor of transducers and antennas can be directly considered in the measurement result. A transducer factor consists of a numeric values and a unit. The R&S FSC corrects the level values of the trace by the values of the transducer. At the same time, the unit of the transducer is assigned to the level axis. When field-strength measurements are performed with the aid of antennas, for instance, the electrical field strength is directly indicated in dBµV/m on the R&S FSC. A transducer factor can also be used to correct a frequency-dependent attenuation, e.g. of a cable between DUT and RF input of the R&S FSC.

More than 100 transducer factors with 60 reference values each can be stored internally. The maximum number of transducer factors may be reduced if cable models, channel tables, limit lines, or data sets are stored simultaneously (see "Saving and Loading Instrument Settings and Measurement Results" in this chapter).

Interpolation between the values is performed with the aid of a modified spline algorithm. Even if only relatively few values such as maxima, minima and turning points are available, this algorithm can easily simulate the correction factors of common transducers. Two transducers can be switched on at a time. The second transducer must be assigned the unit dB. The R&S FSC adds the two transducers to a total transducer.

Transducer factors are defined with the aid of control software FSCView. They are transferred from the PC to the instrument via LAN or the USB interface.

Units supported for transducer factors:

* dB
* dBµV/m
* dBµA/m
* W/m^2

The unit dB does not change the unit set on the R&S FSC. It can be used, for instance, to compensate for frequency-dependent loss and gain at the input of the R&S FSC. The units dBµV/m and dBµA/m convert the output power of an antenna into electric or magnetic field strength. The unit W/m^2 is used to calculate and display the power flux density.

For example, to compensate for the cable loss between the transducer and the RF input, the R&S FSC can use two transducers at the same time. One of them must have the unit dB, however, i.e. it must correspond to one loss or gain value.

Operating sequence:

➢ Press the AMPT key.

➢ Press the TRANSDUCER softkey.

   The softkey menu for operation of transducer factors is displayed on the screen.

Note:

   Transducer factors are not available for measurements with the tracking generator or the Power Sensors. The TRANSDUCER softkey is therefore interactive.
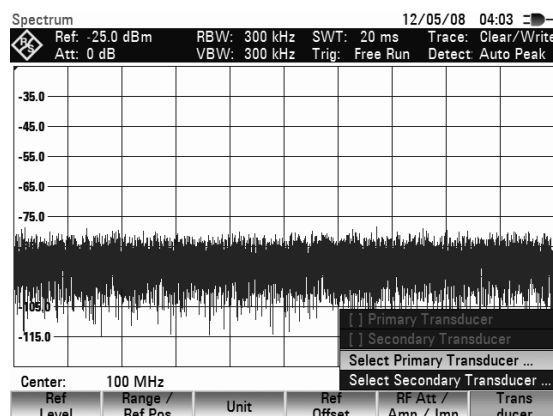
Two transducer factors can be selected with the menu entries SELECT PRIMARY TRANSDUCER and SELECT SECONDARY TRANSDUCER. [ ] PRIMARY TRANSDUCER and [ ] SECONDARY TRANSDUCER are used to switch the selected transducer factors on and off.

> ➢ Press the SELECT PRIMARY TRANSDUCER softkey.

The R&S FSC displays a list of transducer factors available in the unit. The cursor is on the active transducer factor (line highlighted). If no transducer is active, the cursor is on the first item in the list.

> ➢ Select the desired transducer factor with the rotary knob or the cursor keys and switch it on with the SELECT softkey.

> ➢ Quit the transducer menu with the EXIT softkey.
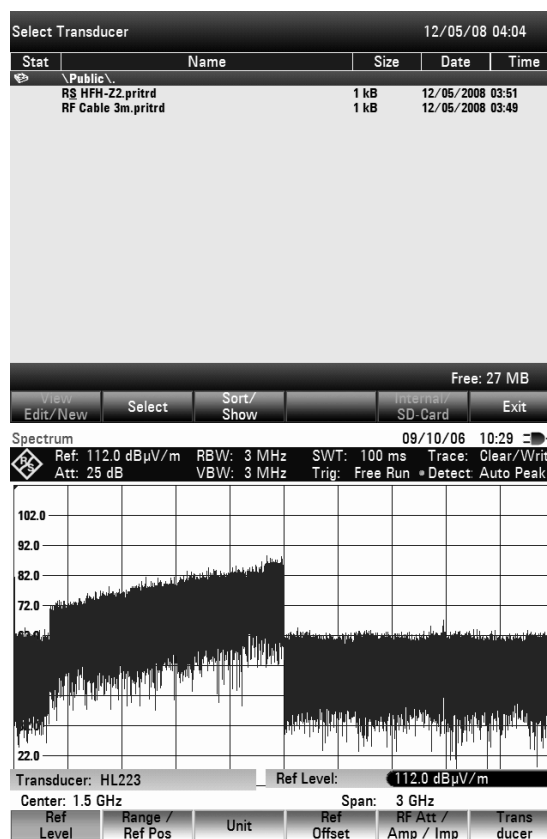
If a transducer is switched on, the R&S FSC shows the selected transducer after the AMPT key is pressed.

The complete name of the selected transducer is also displayed in the status line (press the SETUP key and scroll down the list), or in the list of transducer factors (entry highlighted in red).

The example (Fig. right) shows the transducer factor of the R&S HL223 antenna, which is defined as between 200 MHz and 1300 MHz. The R&S FSC therefore displays the noise in this frequency range as a function of frequency incremented by the transducer factor. Outside the transducer range, the R&S FSC sets the transducer factor at zero, i.e. measurements in this range do not yield conclusive results.

A second transducer factor can be selected with the SELECT SECONDARY TRANSDUCER softkey, which is then added to the first, as soon as the menu entry . [ ] SELECT SECONDARY TRANSDUCER is marked with an X. The unit of the second transducer factor must always be the relative unit dB as otherwise an addition would not be useful. When SELECT SECONDARY TRANSDUCER is selected, the R&S FSC offers only the transducer factors stored in the instrument with dB as the unit.

4.15.1   Unit for Measurements with Transducers

If the unit of the transducer is dB, the units dBm, dBmV or dBµV remain unchanged. The linear units Volt and Watt are not permissible. They are deactivated in the units menu.

If the unit of the transducer is dBµV/m or dBµA/m, this unit is also used for the R&S FSC level display. This means that both the level axis of the diagram and the level at the marker position are assigned the unit of the transducer. If dBµV/m is selected as the transducer unit, switchover to absolute level indication in V/m is possible.

Switchover to V/m level indication:

> ➢ Press the AMPT key.

> ➢ Press the UNIT softkey.

> ➢ In the UNIT menu, select V by means of the rotary knob or the cursor keys and confirm with the ENTER key or by pressing the UNIT softkey again.

If a transducer with the unit dBµA/m is switched on, no other unit can be selected in the AMPT menu. Level indicaion is entirely in dBµA/m.

4.15.2   Reference Level Settings for Measurements with Transducers

The transducer shifts the trace by its value as a function of frequency. Positive transducer values increase the level, negative values reduce it. To ensure that the trace is always within the diagram, the R&S FSC adjusts the reference level accordingly. The reference level is shifted by the maximum transducer value in the positive or negative direction.

4.15.3   Frequency Range of Transducer

If the set frequency range is wider than the span in which a transducer is defined, the R&S FSC assumes the transducer values outside the defined range to be zero.

4.15.4   Data Sets Containing Transducer Factors

The R&S FSC stores data sets together with any transducer factors that may have been active for the measurement n question. When such a data set is recalled, the associated transducer factor(s) are switched on as well. Transducer factors recalled as part of a data set do however not appear in the list of transducer factors.

4.16   Saving and Loading Instrument Settings and Measurement Results

The R&S FSC's settings and measurement results can be saved to the internal memory and recalled at a later date. Using the R&S FSCView software package, these data sets can also be saved to a PC from the R&S FSC or downloaded onto the R&S FSC from a PC.

Results and settings, including the measurement function, are always saved en bloc so that when the results are recalled the measurement context is clear. The R&S FSC can store at minimum 100 data sets which are assigned a unique name.

Data sets for scalar transmission and reflection measurements can be stored along with their calibration data. When such data sets are recalled, therefore, measurements can be performed without prior calibration. Saving a data set with calibration data, however, requires twice as much memory space as without it, i.e. a data set with calibration data takes up the space required for two data sets without calibration data. This reduces the maximum number of data sets that can be stored by the number of data sets stored with calibration data.

If cable models, channel tables, limit lines or transducer factors are stored simultaneously, the maximum number of data sets will be reduced. In addition, the size of the data sets can vary as a function of the selected measurement function. A complete data set uses approx 100 kB of memory.

The R&S FSC provides a total internal storage space of approx 20 MB. In addition data sets, cable models, channel tables, limit lines and transducer factors can be stored on a SD card or on a memory stick. Thus the amount of data sets that can be stored depends only on the size of the SD card or memory stick in use.

➢   Press the SAVE/RCL key.
    The R&S FSC opens the file manager.
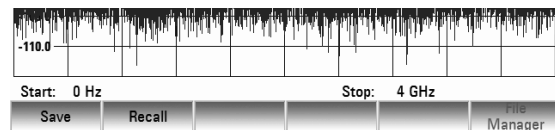
4.16.1   Saving Results

➢   Press the SAVE softkey.
    The R&S FSC opens the "Save Dataset" dialog box.

The ***Name*** entry box, which is highlighted in red, also suggests a name for the data set (DATASET.003) which can be accepted by pressing the ENTER key.

For the sake of simplicity, the R&S FSC also saves the data set when the SAVE softkey under the suggested name is pressed twice.

The remaining *free memory* size (***Free xx MB)*** is also displayed in the dialog box.

The default file name for datasets is "Dataset###.set" with a new number in ascending order for each new dataset. The file extension for datasets is *.set.

If you enter another name, the R&S FSC uses that name and assigns a new number to the file name if you save the data set the next time.

Consecutive data set names can then be assigned by simply saving with SAVE or ENTER.

The names of the data sets already stored can be displayed one after the other using the BACK key. This allows, for example, to store new results under the name of a previous data set (for example

Antenna.000), but with a new extension. The R&S FSC displays the old name together with the first unassigned extension, e.g. Antenna.001. No new name has to be entered.

4.16.2   Entering a Data Set Name

A new name can be entered with the numeric keypad. The letter assignment for the keypad is the same as that for a mobile phone
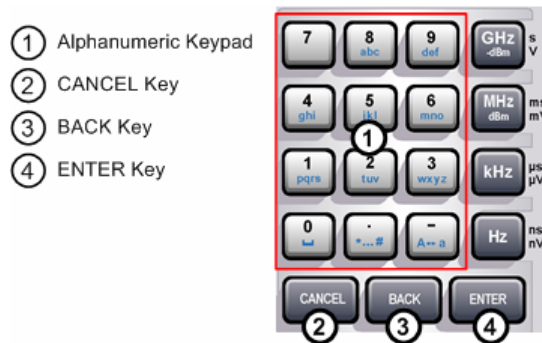
If the R&S FSC is expecting a letter entry, it automatically assigns the letters above the keys to the keys in the alphanumeric keypad. The keys have a multiple assignment. Enter the letter you want by pressing the key in question the appropriate number of times.

➢ Using the alphanumeric keypad enter a name for the data set and terminate the entry with the ENTER key.

  The data set is saved to the R&S FSC's internal memory under the name that has been given.

4.16.3   Loading Measurement Results

Previously saved measurement results and settings can be recalled with the R&S FSC's recall function.

➢ Press the RECALL softkey.

  The R&S FSC opens a list of all the data sets that have been saved.

  The red selection bar indicates the last data set to have been saved.

  Using the cursor keys, you can position the selection bar at the top or bottom of the page. This means fast scrolling if many data sets have been saved in the R&S FSC's memory.

  You can quit the menu by pressing the EXIT softkey. The R&S FSC returns to its previous settings.

Previewing data sets

➢ Using the rotary knob or the cursor keys select a data set.

➢ Preview the data set by pressing the RECALL softkey.

  The R&S FSC shows a preview of the selected data set. The preview is like a screenshot of the last measurement that was done with the settings corresponding to that data set.

  The settings corresponding to the dataset, however, are not yet activated.

➢ Use the rotary knob to scroll through and preview all available data sets.

  The currently active data set is displayed below the measurement screen. In addition to the trace, the R&S FSC also shows the settings of that particualr measurement.

Loading data sets

➢ Press the ACTIVATE softkey to load the settings of the data sets or the EXIT softkey to quit previewing the data sets.

If you choose to activate a data set, the R&S FSC loads the settings corresponding to that particular data set to perform future measurements.

If you choose to exit the preview of data sets, the R&S FSC returns to the file manager ('Recall Data Sets' dialog).

4.16.4   Deleting Data Sets

Previously saved data sets can be deleted individually.

➢ Press the SAVE/RECALL key.

➢ Press the FILE MANAGER softkey.
The R&S FSC opens the file manager.

➢ In order to delete a single dataset, press the SELECT ACTION softkey. Select DELETE and the dataset currently under the cursor is deleted after your confirmation.

➢ In order to delete multiple data sets, the respective data sets have to be marked first.

➢ Press the MARK softkey to mark files for deletion

➢ Select the data set you'd like to delete using the rotary knob or the cursor keys. Mark the data sets with the ENTER key.
The selected data sets should be checked in the STATUS column.

➢ Repeat the selection by moving the cursor with the rotary knob or the cursor key and marking more data sets with the ENTER key.

➢ Press the SELECT ACTION softkey.

➢ Select the DELETE menu item and confirm with the ENTER key or the SELECT ACTION softkey.
Before deleting the data set, the R&S FSC shows a warning message that you need to confirm. When confirming the deletion process the R&S FSC deletes the selected data sets from its memory.
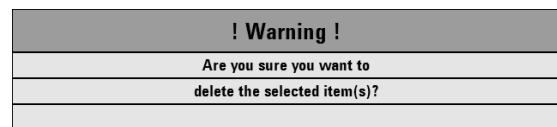
4.17   How a Spectrum Analyzer Works

Basically, an RF signal can either be analyzed in the time domain or in the frequency domain.

In the time domain, how the signal varies with time can be observed on an oscilloscope, for example. In the frequency domain, a spectrum analyzer can be used to display the frequency components of a signal.

Both modes are essentially equivalent because applying the Fourier transform to any signal converts it into its spectral components. However, depending on the signal characteristic to be measured, one method is usually more appropriate than the other. Just by glancing at an oscilloscope, it is possible to tell whether a measurement signal is a sine signal, a squarewave with a certain on/off ratio or a sawtooth. However, it is not at all obvious what the harmonic content of the signal is or if low-level signals are superimposed. This is easy to see with a spectrum analyzer.

The following Fig. shows the theoretical basis of the two measurement techniques. In the time domain, an oscilloscope is showing a section of a signal which is approximately a squarewave. The same signal viewed with a spectrum analyzer shows a line spectrum, i.e. the fundamental and harmonics.
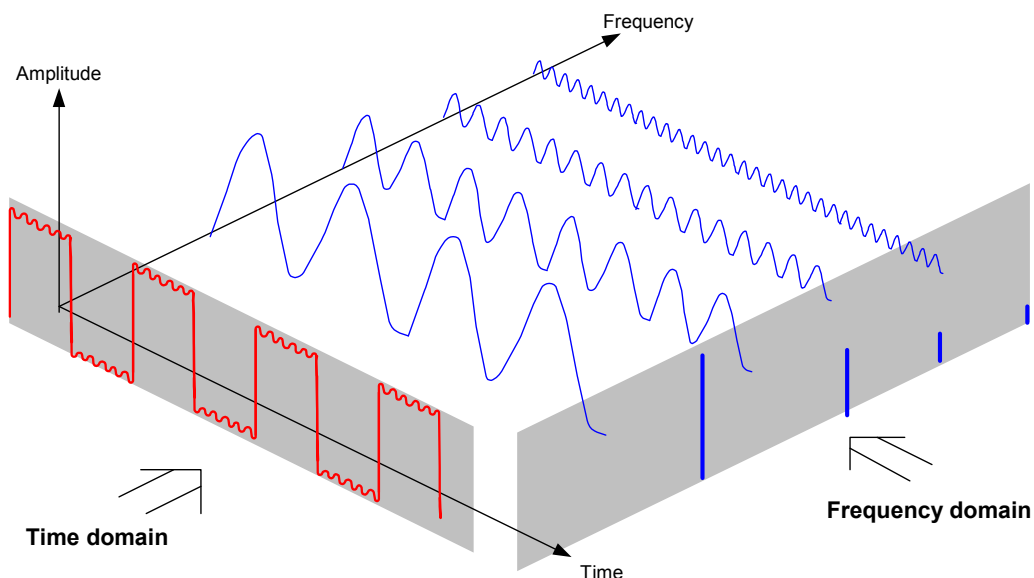
The periodic squarewave in the time domain can be Fourier transformed to the frequency domain. In the case of a squarewave there is a fundamental (= frequency of the squarewave) and its odd harmonics. Using a narrow bandpass filter, the spectrum analyzer makes measurements in the frequency domain. Only at frequencies where there is a signal is there a reading which gives the amplitude of the frequency component.

The block diagram below shows how a spectrum analyzer works.
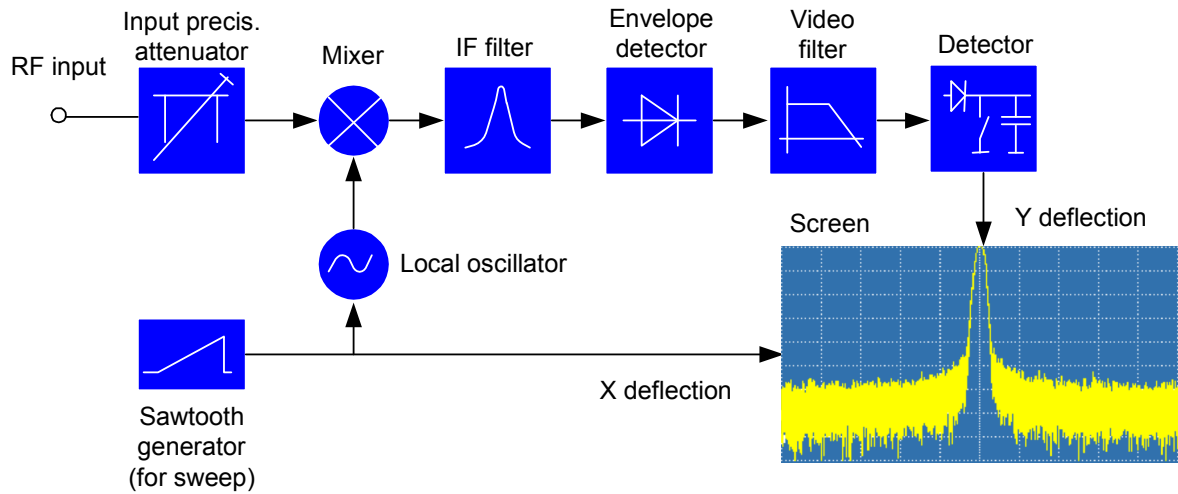
The precision attenuator at the input of the spectrum analyzer adjusts the level of the measurement signal to the level range that the mixer can handle without overdriving it. The precision attenuator at the input of the R&S FSC is adjustable in 10 dB steps from 0 dB to 30 dB and is directly coupled to the reference level setting.

The mixer converts the RF input signal to a fixed IF. Conversion is usually performed in several stages to an IF for which good narrowband IF filters are available. The R&S FSC3 has three mixing stages with the IFs 4856 MHz, 831.4 MHz and 21.4 MHz. Up to 3.6 GHz, the R&S FSC6 uses the same IFs as the R&S FSC3. Between 3.6 GHz and 6 GHz, it uses a first IF at 8856 MHz, which it converts to the second IF of 831.4 MHz with the aid of the second local oscillator. As of the second IF, the signal path for the two ranges is identical.

A local oscillator that can be tuned from 4.8 GHz to 8.4 GHz is used in the R&S FSC3 for conversion to the first IF so that a certain input frequency is converted to the first IF. The further conversions are performed by single-frequency oscillators.

The frequency of the local oscillator determines the input frequency at which the spectrum analyzer performs measurements:

$f_{in} = f_{LO} - f_{IF.}$

The first mixer produces the sum frequency $f_{LO} + f_{in}$ (= image frequency f_{image}) as well as the difference frequency $f_{LO} - f_{in}$.

The image frequency is rejected by the bandpass at the IF so that it does not interfere with the subsequent frequency conversions.
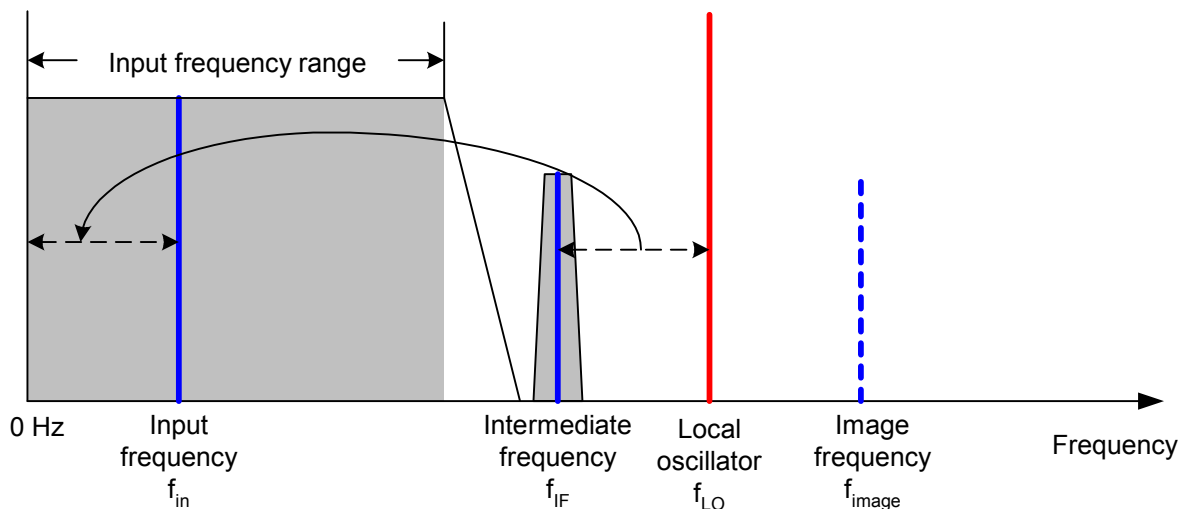
The first local oscillator is tuned with a sawtooth which simultaneously acts as the x deflection voltage for the display. In practice, synthesizer technology is used to generate the frequency of the first local oscillator and for a digital display.

The instantaneous sawtooth voltage therefore determines the input frequency of the spectrum analyzer.

The bandwidth of the IF filter at the IF determines the bandwidth that is used for measurements. Pure sine signals are passed by the IF filter characteristics. This means that signals closer together than the bandwidth of the IF filter cannot be resolved. This is why the bandwidth of the IF filter in a spectrum analyzer is referred to as the resolution bandwidth. The R&S FSC has resolution bandwidths from 1 kHz to 1 MHz.

The bandlimited IF is passed to the envelope detector. The envelope detector removes the IF from the signal and outputs its envelope. The output signal from the envelope detector is referred to as the video signal. As it has been demodulated, it only contains amplitude information. The phase information is lost.

With RF sine signals, the video signal is a DC voltage. With AM signals the video signal contains a DC component whose amplitude corresponds to the carrier power and an AC component whose frequency is equal to the modulation frequency, provided the modulation frequency is inside the resolution bandwidth.

IF signal (AM)   ➡   Envelope signal
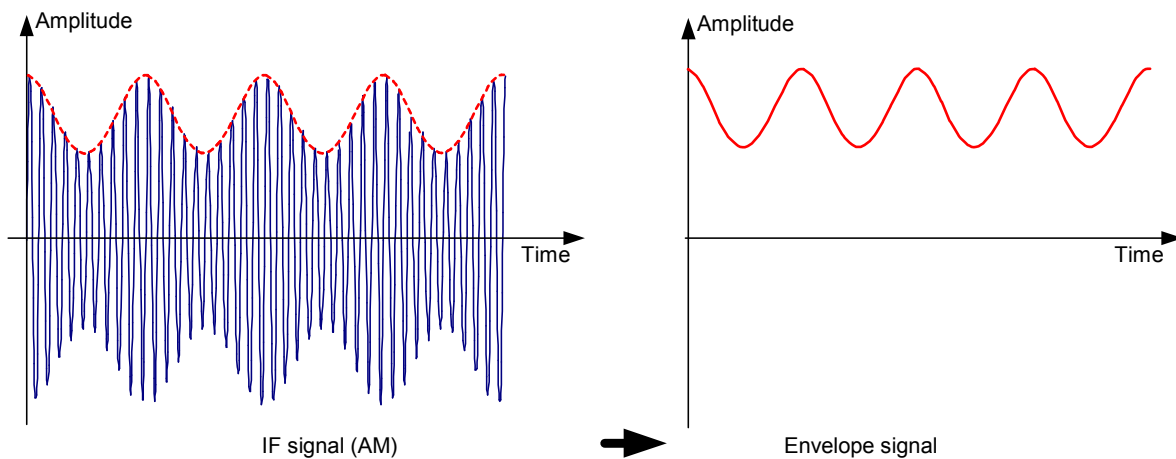
The video filter comes after the envelope detector. The filter is a lowpass with an adjustable cutoff frequency which limits the bandwidth of the video signal. It is particularly useful when sine signals are to be measured in the vicinity of the spectrum analyzer's intrinsic noise. The sine signal produces a video signal that is a DC voltage. At the IF, however, the noise is distributed over the whole bandwidth or, in the case of the video signal, over half the bandwidth of the resolution filter. By selecting a narrow video bandwidth relative to the resolution bandwidth, the noise can be suppressed, while the sine signal to be measured (= DC) is not affected.

The Figs. below show a weak sine signal. In the first Fig., it is measured with a large video bandwidth and in the second with a narrow video bandwidth.
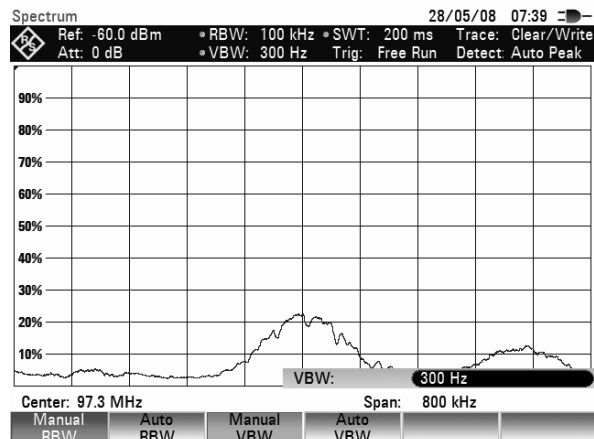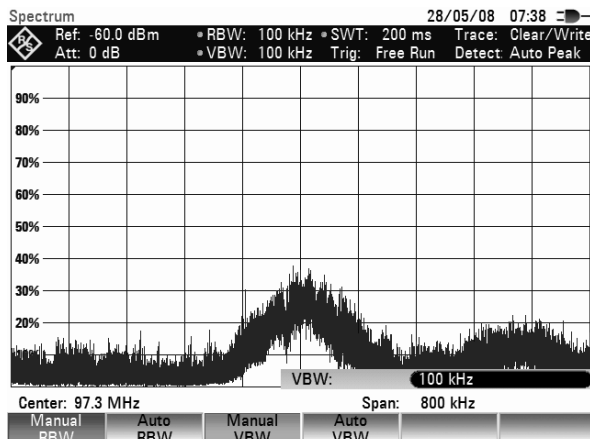
Limiting the video bandwidth smoothes the trace considerably. This makes it much easier to determine the level of the measured signal.

The detector comes after the video filter. The detector combines the measured spectrum so that it can be represented as one pixel in the trace. The R&S FSC uses 301 pixels to form the trace, i.e. the whole measured spectrum has to be represented using just 301 pixels. Common types of spectrum analyzer detectors are the peak detector (PEAK), the sample detector (SAMPLE) and the RMS detector (RMS). An Auto Peak detector which simultaneously displays the maximum peak and the minimum peak is usually also provided. The Fig. below explains how these detectors work.
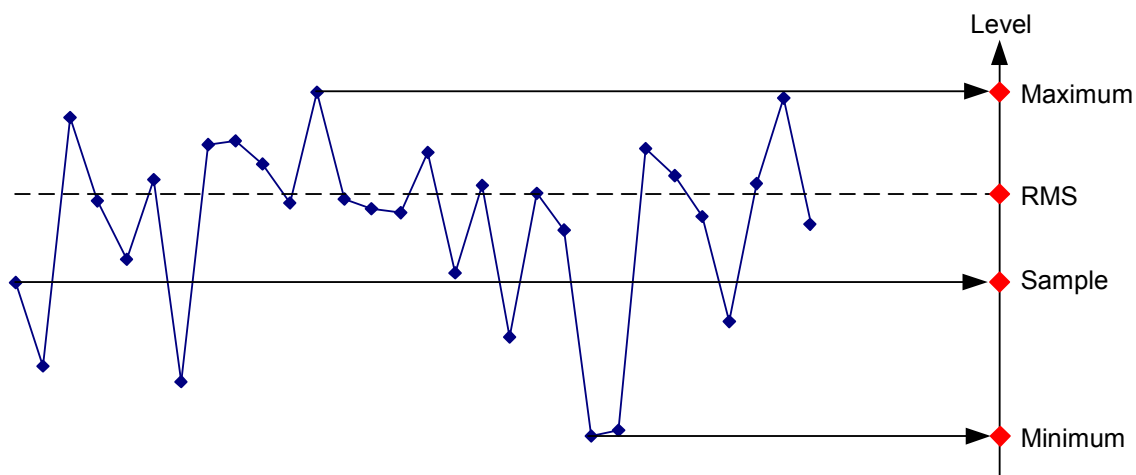
The Fig. above shows 30 measured values which are represented by a single pixel. The peak detector determines and displays the maximum measured value. The Auto Peak detector takes the maximum and minimum and displays them together. The two values are joined by a vertical line segment. This gives a good indication of the level variation over the measured values represented by a single pixel. The RMS detector is used by the spectrum analyzer to determine the RMS value of the measured values. It is therefore a measure of the spectral power represented by a pixel. The sample detector takes an arbitrary measurement value and displays it (in the Fig. above, the first). The other measured values are ignored.

On the basis of the operating principles of detectors, a few recommendations can be made as to their use.

- It is best to use the Auto Peak detector or the peak detector for spectrum analysis over large frequency ranges. This ensures that all signals are displayed.

- The RMS detector is recommended for power measurements on modulated signals. However, the display range should be chosen so as not to exceed 100 times the bandwidth of the signal or the resolution bandwidth, whichever is larger.

- The sample detector or the RMS detector (preferred) should be used for noise measurements. Only these two detectors are capable of measuring noise power correctly.

- When measurements are made on sine signals, the level display does not depend on the detector. However, if you use the RMS detector or the sample detector, ensure that the span is not too great. Otherwise, the displayed levels of sine signals may be lower than their true value.

5 Remote Control Operation

5.1 Interfaces and Protocols

The R&S FSC supports two different interfaces for remote control.

- LAN Interface: The protocol is based on TCP/IP and supports the VXI-11 standard.

- USB Interface

The connectors are located at the side of the instrument and permit a connection to a controller for remote control via a local area network (LAN) or directly via USB.

5.1.1.1 SCPI

SCPI (Standard Commands for Programmable Instruments) commands - messages - are used for remote control. Commands that are not taken from the SCPI standard follow the SCPI syntax rules. The instrument supports the SCPI version 1999. The SCPI standard is based on standard IEEE 488.2 and aims at the standardization of device-specific commands, error handling and the status registers. The tutorial "Automatic Measurement Control - A tutorial on SCPI and IEEE 488.2" from John M. Pieper (R&S order number 0002.3536.00) offers detailed information on concepts and definitions of SCPI.

The requirements that the SCPI standard places on command syntax, error handling and configuration of the status registers are explained in detail in the following sections. Tables provide a fast overview of the bit assignment in the status registers. The tables are supplemented by a comprehensive description of the status registers.

5.1.1.2 VISA

VISA is a standardized software interface library providing input and output functions to communicate with instruments. The I/O channel (LAN or USB) is selected at initialization time by means of a channel-specific resource string. For more information about VISA refer to its user documentation.

The programming examples for remote control are all written in Microsoft® VISUAL BASIC®. Access to the VISA functions require the declaration of the functions and constants prior to their use in the project. This can be accomplished either by adding the modules VISA32.BAS and VPPTYPE.BAS or a reference to the VISA32.DLL to the project.
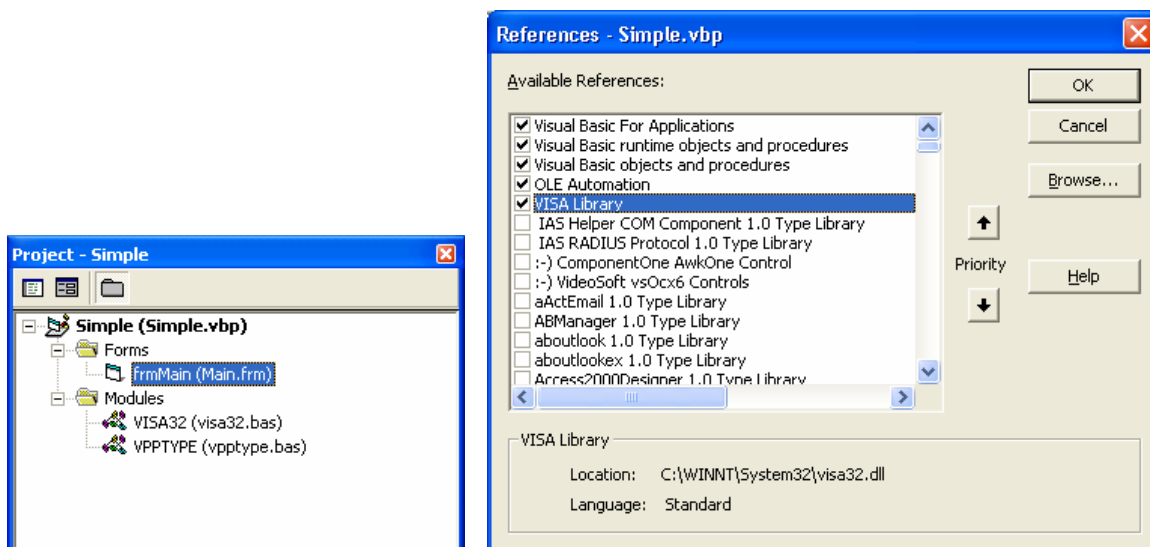
The modules visa32.bas and vpptype.bas can be found in the <VXIpnpPath>\WinNT\include (typically C:\VXIpnp\WinNt\include).

> Manual operation is designed for maximum possible operating convenience. In contrast, the priority of remote control is the "predictability" of the device status. Therefore, control programs should always define an initial device status (e.g. with the command *RST) and then implement the required settings.

5.1.2   LAN Interface

To be integrated in a LAN, the instrument is equipped with a standard LAN interface, consisting of a connector, a network interface and protocols (VXI-11).

Instrument access via VXI-11 is usually achieved from high level programming platforms by using VISA as an intermediate abstraction layer. VISA encapsulates the low level VXI-11 (LAN) or USB function calls and thus makes the transport interface transparent for the user. The necessary VISA library is available as a separate product. For details contact your local R&S sales representative.

5.1.3   USB Interface

For remote control via the USB connection, the PC and the instrument must be connected via the USB interface. A USB connection requires the VISA library to be installed. VISA detects and configures the instrument automatically when the USB connection is established. You do not have to enter an address string or install a separate driver.

5.1.4   Protocols

5.1.4.1   VXI-11 Basics

The VXI-11 standard is based on the ONC-RPC protocol which in turn relies on TCP/IP as the network/transport layer. The TCP/IP network protocol and the associated network services are preconfigured. TCP/IP ensures connection-oriented communication, where the order of the exchanged messages is adhered to and interrupted links are identified. With this protocol, messages cannot be lost.

Remote control of an instrument via a network is based on standardized protocols which follow the OSI reference model (see Fig. below).

Application	SCPI
Presentation	XDR (VXI-11)
Session	ONC-RPC
Transport	TCP / UDP
Network	IP
Data Link	Ethernet/802.3
Physical	802.3/10BASE-T

Figure 1: Example for LAN remote control based on the OSI reference model

---

Based on TCP/UDP, messages between the controller and the instrument are exchanged via open network computing (ONC) - remote procedure calls (RPC). With XDR (VXI-11), legal RPC messages are known as VXI-11 standard. Based on this standard, messages are exchanged between the controller and the instrument. The messages are identical with SCPI commands. They can be organized in four groups:

- program messages (control command to the instrument)

- response messages (values returned by the instrument)

- service request (spontaneous queries of the instrument)

- low-level control messages (interface messages).

A VXI-11 link between a controller and an instrument uses three channels: core, abort and interrupt channel. Instrument control is mainly performed on the core channel (program, response and low-level control messages). The abort channel is used for immediate abort of the core channel; the interrupt channel transmits spontaneous service requests of the instrument. Link setup itself is very complex. For more details refer to the VXI-11 specification.
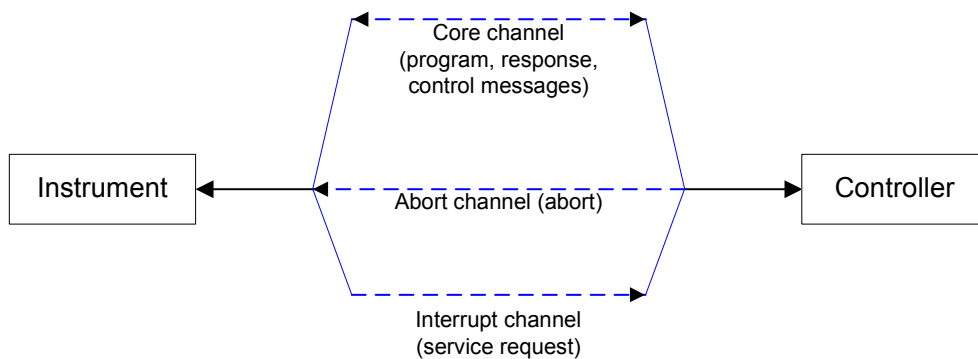

Figure 2: VXI-11 channels between instrument and controller

The number of controllers that can address an instrument is practically unlimited in the network. In the instrument, the individual controllers are clearly distinguished. This distinction continues up to the application level in the controller, i.e. two applications on a computer are identified by the instrument as two different controllers.
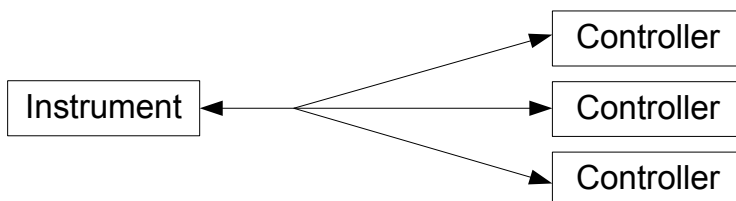

Figure 3: Remote control via LAN from several controllers

The controllers can lock and unlock the instrument for exclusive access. This regulates access to the instrument of several controllers.

5.2 Setting Up the Remote Control Connection

5.2.1.1 Preparing for Remote Control

The short and simple operating sequence below shows how to put the instrument into operation and quickly set its basic functions. The current IP address for LAN operation is shown in the SETUP – Instrument Setup Menu. In case of USB connection the IP address is fixed to 172.16.10.10..

Refer to the Quick Start Guide, chapter "Setting up a LAN or USB Connection to a PC", for instructions on how to change the IP address.

1. Connect the instrument to the LAN or directly to the controller via USB.

2. Switch on the instruments.

3. Write and start the following program on the controller:

`status = viOpenDefaultRM(defaultRM)`	' Open default resource manager
`status = viOpen(DefaultRM,` `"TCPIP::172.16.10.10", 0, 0, vi)`	' in case of USB connection
`Status = viopen(DefaultRM,` `"TCPIP::xxx.xxx.xxx.xxx", 0, 0, vi)`	'in case of a LAN connection, with xxx.xxx.xxx.xxx = IP address
`Cmd = "*RST;*CLS"` `status = viWrite(vi, Cmd, Len(Cmd), retCount)`	' Reset instrument and clear status registers
`Cmd = "FREQ:CENT 100MHz"` `status = viWrite(vi, Cmd, Len(Cmd), retCount)`	' Set center frequency to 100 MHz
`Cmd = "FREQ:SPAN 10MHz"` `status = viWrite(vi, Cmd, Len(Cmd), retCount)`	' Set span to 10 MHz
`Cmd = "DISP:TRAC:Y:RLEV -10dBm"` `status = viWrite(vi, Cmd, Len(Cmd), retCount)`	' Set reference level to -10 dBm
`viclose vi`	
`viclose default RM`	

The instrument now performs a sweep in the frequency range of 95 MHz to 105 MHz.

5.2.1.2 Changing the IP Address

In order to operate the instrument via remote control, it must be accessed via LAN (IP address) or USB. If the factory-set remote control address does not fit in the network environment, it can be changed. Refer to the Quick Start Guide, chapter "Setting up a LAN or USB Connection to a PC", for instructions on how to change the IP address.

5.3   Instrument Model and Command Processing

The block diagram in Fig. 1-2 shows how SCPI commands are serviced in the instrument. The individual components work independently and simultaneously. They communicate with each other by means of so-called "messages".
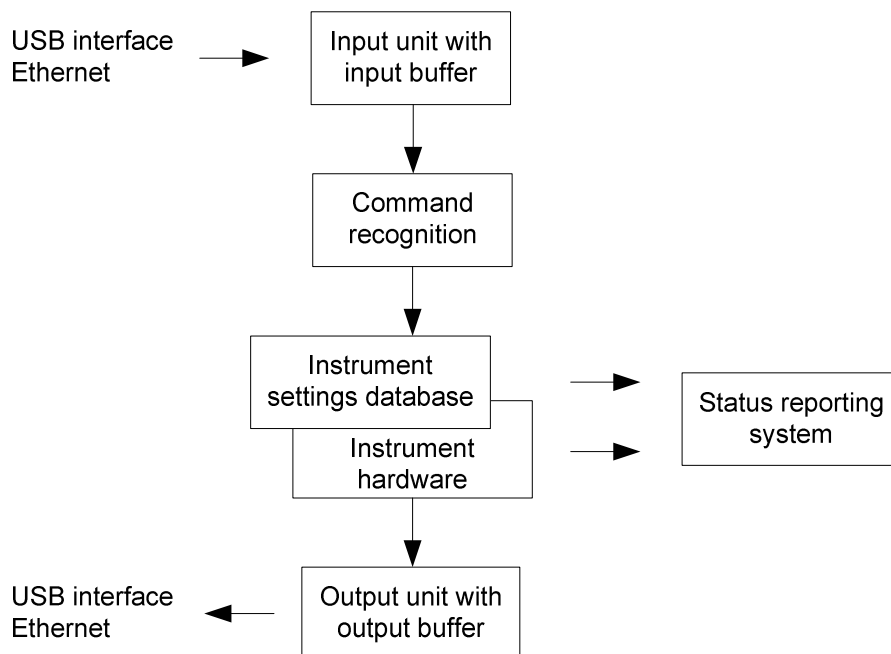

Figure 4: Instrument model in the case of remote control

5.3.1.1   Input unit

The input unit receives commands character by character from the controller and collects them in the input buffer. The input unit sends a message to the command recognition as soon as the input buffer is full or as soon as it receives a delimiter, <PROGRAM MESSAGE TERMINATOR>, as defined in IEEE 488.2, or the interface message DCL.

If the input buffer is full, the traffic is stopped and the data received up to then are processed. Subsequently the traffic is continued. If, however, the buffer is not yet full when receiving the delimiter, the input unit can already receive the next command during command recognition and execution. The receipt of DCL clears the input buffer and immediately resets the command recognition.

5.3.1.2   Command recognition

The command recognition analyses the data received from the input unit. It proceeds in the order in which it receives the data. Only DCL is serviced with priority, for example GET (Group Execute Trigger) is only executed after the commands received before. Each recognized command is immediately transferred to the internal instrument settings data base but not executed immediately.

The command recognition detects syntax errors in the commands and transfers them to the status reporting system. The rest of a program message after a syntax error is analyzed further if possible and serviced. After the syntax test, the value range of the parameter is checked, if required.

If the command recognition detects a delimiter, it passes the command to an execution unit that performs the instrument settings. In the meantime, the command recognition is ready to process new commands (overlapping execution). A DCL command is processed in the same way.

5.3.1.3 Data base and instrument hardware

Here the expression "instrument hardware" denotes the part of the instrument fulfilling the actual instrument function - signal generation, measurement etc. The controller is not included. The term "data base" denotes a database that manages all the parameters and associated settings required for setting the instrument hardware.

Setting commands lead to an alteration in the data set. The data set management enters the new values (e.g. frequency) into the data set, however, only passes them on to the hardware when requested by the command recognition. This only takes place at the end of a program message.

The data are checked for compatibility with the current instrument settings before they are transmitted to the instrument hardware. If the execution is not possible, an "execution error" is signaled to the status reporting system. The corresponding settings are discarded.

Before passing on the data to the hardware, the settling bit in the STATus:OPERation register is set (refer to section "STATus:OPERation Register"). The hardware executes the settings and resets the bit again as soon as the new state has settled. This fact can be used to synchronize command servicing.

Queries induce the data set management to send the desired data to the output unit.

5.3.1.4 Status reporting system

For detailed information refer to section "Status Reporting System".

5.3.1.5 Output unit

The output unit collects the information requested by the controller, which it receives from the data base management. It processes it according to the SCPI rules and makes it available in the output buffer.

If the instrument is addressed as a talker without the output buffer containing data or awaiting data from the data base management, the output unit sends error message "Query UNTERMINATED" to the status reporting system. No data are sent to the controller, the controller waits until it has reached its time limit. This behavior is defined by IEEE 488.2 and SCPI.

5.4   SCPI Command Structure and Syntax

SCPI (Standard Commands for Programmable Instruments) describes a standard command set for programming instruments, irrespective of the type of instrument or manufacturer. The goal of the SCPI consortium is to standardize the device-specific commands to a large extent. For this purpose, a model was developed which defines the same functions inside a device or for different devices. Command systems were generated which are assigned to these functions. Thus it is possible to address the same functions with identical commands. The command systems are of a hierarchical structure.

SCPI is based on standard IEEE 488.2, i.e. it uses the same syntactic basic elements as well as the common commands defined in this standard. Part of the syntax of the device responses is defined with greater restrictions than in standard IEEE 488.2 (see section "Responses to Queries").

Not all commands used in the following examples are implemented in the instrument.

5.4.1   Structure of a Command

The commands consist of a so-called header and, in most cases, one or more parameters. Header and parameter are separated by a "white space" (ASCII code 0 to 9, 11 to 32 decimal, e.g. blank). The headers may consist of several key words. Queries are formed by directly appending a question mark to the header.

5.4.1.1   Common commands

Common commands consist of a header preceded by an asterisk "*" and one or several parameters, if any.

Examples:

`*RST`	RESET, resets the device
`*ESE 253`	EVENT STATUS ENABLE, sets the bits of the event status enable register
`*ESR?`	EVENT STATUS QUERY, queries the contents of the event status register.

5.4.1.2   Device-Specific Commands

Hierarchy

Device-specific commands are of hierarchical structure (see Figure 5). The different levels are represented by combined headers. Headers of the highest level (root level) have only one key word. This key word denotes a complete command system.

> *Example*
>
> SENSe
>
> This key word denotes the SENSe command system.

For commands of lower levels, the complete path has to be specified, starting on the left with the highest level, the individual key words being separated by a colon ":".

Example

    SENSe:FREQuency:SPAN 10MHZ

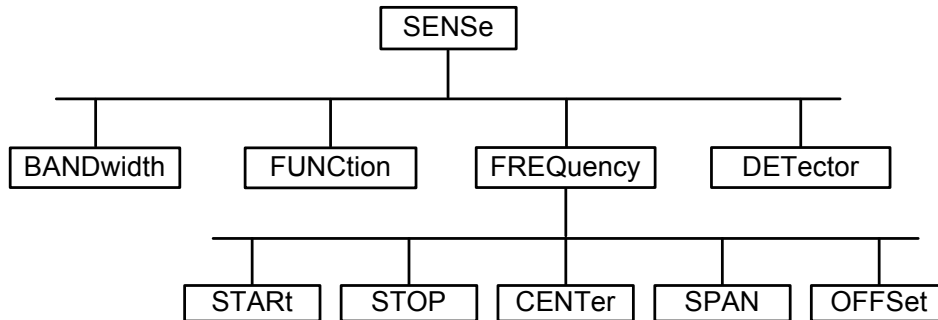This command lies in the third level of the SENSe system. It sets the frequency span.

```
                              ┌─────────┐
                              │  SENSe  │
                              └────┬────┘
        ┌──────────────┬──────────┼──────────────┬──────────────┐
  ┌───────────┐  ┌───────────┐  ┌───────────┐  ┌───────────┐
  │ BANDwidth │  │ FUNCtion  │  │ FREQuency │  │ DETector  │
  └───────────┘  └───────────┘  └─────┬─────┘  └───────────┘
                    ┌────────┬─────────┼─────────┬─────────┐
               ┌────────┐ ┌──────┐ ┌────────┐ ┌──────┐ ┌────────┐
               │ STARt  │ │ STOP │ │ CENTer │ │ SPAN │ │ OFFSet │
               └────────┘ └──────┘ └────────┘ └──────┘ └────────┘
```

Figure 5: Tree structure the SCPI command systems using the SENSe system as example

Multiple key words

Some key words occur in several levels within one command system. Their effect depends on the structure of the command, i.e. at which position in the header of a command they are inserted.

Example

    SOURce:FM:POLarity NORMal

This command contains key word POLarity in the third command level. It defines the polarity between modulator and modulation signal.

Example

    SOURce:FM:EXTernal:POLarity NORMal

This command contains key word POLarity in the fourth command level. It defines the polarity between modulation voltage and the resulting direction of the modulation only for the external signal source indicated.

Optional key words

Some command systems permit certain key words to be inserted into the header or omitted. These key words are marked by square brackets in the description. The full command length must be recognized by the instrument for reasons of compatibility with the SCPI standard. Some commands are considerably shortened by these optional key words.

Example

    [SENSe]:BANDwidth[:RESolution]:AUTO

This command couples the resolution bandwidth of the instrument to other parameters. The following command has the same effect:

    BANDwidth:AUTO

Optional keywords with numeric suffixes

Do not omit an optional keyword if it includes a numeric suffix that is relevant for the effect of the command.

Example

DISPlay[:WINDow<1...4>]:MAXimize <Boolean>

Command DISP:MAX ON refers to window 1.

In order to refer to a window other than 1, you must include the optional WINDow parameter with the suffix for the required window.

DISP:WIND2:MAX ON refers to window 2.

Long and short form

The key words feature a long form and a short form. Either the short form or the long form can be entered, other abbreviations are not permitted.

Example

STATus:QUEStionable:ENABle 1 is equivalent to STAT:QUES:ENAB 1

Upper-case and lower-case notation only serves to distinguish the two forms in the manual, the instrument itself does not distinguish upper-case and lower-case letters.

Parameter

The parameter must be separated from the header by a "white space". If several parameters are specified in a command, they are separated by a comma ",". A few queries permit the parameters MINimum, MAXimum and DEFault to be entered. Refer to "Parameters" for a detailed description of the various parameters.

Example

SENSe:FREQuency:STOP? MAXimum, Response: 3.5E9

This query requests the maximal value for the stop frequency.

Special Characters

	A vertical stroke in parameter definitions indicates alternative possibilities in the sense of "or". The effect of the command differs, depending on which parameter is used.
	Example
	DISPlay:FORMat SINGle | SPLit
	If parameter SINGle is selected, full screen is displayed, in the case of SPLit, split screen is displayed.
	A selection of key words with an identical effect exists for several commands. These keywords are indicated in the same line; they are separated by a vertical stroke. Only one of these keywords needs to be included in the header of the command. The effect of the command is independent of which of the keywords is used.
	Example
	SENSe:BANDwidth|BWIDth[:RESolution]
	The two following commands with identical meaning can be created. They set the frequency of the fixed frequency signal to 1 kHz:
	SENSe:BAND 1
	SENSe:BWID 1

[]	Key words in square brackets can be omitted when composing the header. The full command length must be accepted by the instrument for reasons of compatibility with the SCPI standards.
	Example
	`[SENSe:]BANDwidth|BWIDth[:RESolution]`
	`SENS:BAND:RES` is equivalent to `BAND`
	Parameters in square brackets can be incorporated optionally in the command or omitted as well.
	Example
	`MMEMory:NETWork:MAP <string>,<string>[,string>,<string>,<boolean>]`
	Entries in square brackets are optional or can be omitted.
{}	Parameters in curly brackets are optional and can be inserted once or several times, or omitted.
	Example
	`SENSe:LIST:FREQuency <numeric_value>{,<numeric_value>}`
	The following are valid commands:
	`SENS:LIST:FREQ 10`
	`SENS:LIST:FREQ 10,20`
	`SENS:LIST:FREQ 10,20,30,40`

Numeric suffix

If a device features several functions or features of the same kind, e.g. inputs, the desired function can be selected by a suffix added to the command. Entries without suffix are interpreted like entries with the suffix 1. Optional keywords must be specified if they select a function with the suffix.

Example

`SYSTem:COMMunicate:SERial2:BAUD 9600`

This command sets the baud rate of a second serial interface.

> In case of remote control, suffix counting may differ from the numbers of the corresponding selection used in manual operation. SCPI prescribes that suffix counting starts with 1. Suffix 1 is the default state and used when no specific suffix is specified.
>
> Some standards define a fixed numbering, starting with 0. With GSM, for instance, slots are counted from 0 to 7. In the case of remote control, the slots are selected with the suffixes 1 to 8. If the numbering differs in manual operation and remote control, it is indicated with the respective command.

5.4.2   Overview of Syntax Elements

The following table offers an overview of the syntax elements.

:	The colon separates the key words of a command. In a program message the separating semicolon marks the uppermost command level.
;	The semicolon separates two commands within a program message. It does not alter the path.
,	The comma separates several parameters of a command.
?	The question mark forms a query.
*	The asterisk marks a common command.
"	Quotation marks introduce a string and terminate it.
#	The hash symbol # introduces binary, octal, hexadecimal and block data. • Binary: #B10110 • Octal: #O7612 • Hexa: #HF3A7 • Block: #21312
	A "white space" (ASCII-Code 0 to 9, 11 to 32 decimal, e.g. blank) separates header and parameter.

5.4.3   Parameters

For most commands a parameter needs to be supplemented. The parameter has to be separated from the header by a "white space". Possible parameters are:

- Numeric values

- Special numeric values

- Boolean parameters

- Text

- Character strings

- Block data.

The type of parameter required for each command and the allowed range of values are specified in the command description.

5.4.3.1   Numeric Values

Numeric values can be entered in any form, i.e. with sign, decimal point and exponent. Values exceeding the resolution of the instrument are rounded up or down. The mantissa may comprise up to 255 characters, the exponent must lie inside the value range -32000 to 32000. The exponent is introduced by an "E" or "e". Entry of the exponent alone is not permissible. In the case of physical quantities, the unit can be entered. Permissible unit prefixes are G (giga), MA (mega), MOHM and MHZ are also possible), K (kilo), M (milli), U (micro) and N (nano). If the unit is missing, the basic unit is used.

Example
```
SENSe:FREQuency:STOP 1.5GHz = SENSe:FREQuency:STOP 1.5E9
```

5.4.3.2   Special Numeric Values

The texts MINimum, MAXimum, DEFault, UP and DOWN are interpreted as special numeric values. In case of a query, the numeric value is returned.

- MIN/MAX

    MINimum and MAXimum denote the minimum and maximum value.

- DEF

    DEFault denotes a preset value which has been stored in the EPROM. This value conforms to the default setting, as it is called by the `*RST` command

- UP/DOWN

    UP, DOWN increases or reduces the numerical value by one step. The step width can be specified via an allocated step command for each parameter which can be set via UP, DOWN.

- INF/NINF

    INFinity, Negative INFinity (NINF) Negative INFinity (NINF) represent the numerical values -9.9E37 or 9.9E37, respectively. INF and NINF are only sent as device reponses.

- NAN

    Not A Number (NAN) represents the value 9.91E37. NAN is only sent as device response. This value is not defined. Possible causes are the division of zero by zero, the subtraction of infinite from infinite and the representation of missing values.

    Example:

    Setting command: `SENSe:FREQuency:STOP MAXimum`

    Query: `SENSe:FREQuency:STOP?, Response: 3.5E9`

5.4.3.3   Boolean Parameters

Boolean parameters represent two states. The ON state (logically true) is represented by ON or a numerical value unequal to 0. The OFF state (logically untrue) is represented by OFF or the numerical value 0. The numerical values are provided as response for query.

Example

Setting command: `CALCulate:MARKer:STATe ON`

Query: `CALCulate:MARKer:STATe?, Response: 1`

5.4.3.4   Text

Text parameters observe the syntactic rules for key words, i.e. they can be entered using a short or long form. Like any parameter, they have to be separated from the header by a white space. In the case of a query, the short form of the text is provided.

Example

Setting command: `INPut:COUPling GROund`

Query: `INPut:COUPling?, Response: GRO`

5.4.3.5   Strings

Strings must always be entered in quotation marks (' or ").

Example

```
SYSTem:LANGuage "SCPI" or SYSTem:LANGuage 'SCPI'
```

5.4.3.6   Block data

Block data are a transmission format which is suitable for the transmission of large amounts of data. A command using a block data parameter has the following structure:

Example

```
HEADer:HEADer #45168xxxxxxxx
```

ASCII character # introduces the data block. The next number indicates how many of the following digits describe the length of the data block. In the example the 4 following digits indicate the length to be 5168 bytes. The data bytes follow. During the transmission of these data bytes all end or other control signs are ignored until all bytes are transmitted.

5.4.4   Structure of a Program Message

A program message may consist of one or several commands. It is terminated by the program message terminator which is the NL (New Line) charcter for LAN and USB connections.

Several commands in a program message must be separated by a semicolon ";". If the next command belongs to a different command system, the semicolon is followed by a colon. A colon ":" at the beginning of a command marks the root node of the command tree.

Example:

```
CALL InstrWrite(analyzer, "SENSe:FREQuency:CENTer
100MHz;:INPut:ATTenuation 10")
```

> This program message contains two commands. The first one is part of the SENSe command system and is used to determine the center frequency of the instrument. The second one is part of the INPut command system and sets the input signal attenuation.

If the successive commands belong to the same system, having one or several levels in common, the program message can be abbreviated. For that purpose, the second command after the semicolon starts with the level that lies below the common levels (see also Fig. 1-1). The colon following the semicolon must be omitted in this case.

Example:

```
CALL InstrWrite(analyzer, "SENSe:FREQuency:STARt
1E6;:SENSe:FREQuency:STOP 1E9")
```

> This program message is represented in its full length and contains two commands separated from each other by the semicolon. Both commands are part of the SENSe command system, subsystem FREQuency, i.e. they have two common levels.

When abbreviating the program message, the second command begins with the level below SENSe:FREQuency. The colon after the semicolon is omitted. The abbreviated form of the program message reads as follows:

```
CALL InstrWrite(analyzer, "SENSe:FREQuency:STARt 1E6;STOP 1E9")
```

However, a new program message always begins with the complete path.

Example:

```
CALL InstrWrite(analyzer, "SENSe:FREQuency:STARt 1E6")
CALL InstrWrite(analyzer, "SENSe:FREQuency:STOP 1E9")
```

5.4.5   Responses to Queries

A query is defined for each setting command unless explicitly specified otherwise. It is formed by adding a question mark to the associated setting command. According to SCPI, the responses to queries are partly subject to stricter rules than in standard IEEE 488.2.

- The requested parameter is transmitted without header.

  Example

  `INPut:COUPling?,` Response: DC

- Maximum values, minimum values and all further quantities, which are requested via a special text parameter are returned as numerical values.

  Example

  `SENSe:FREQuency:STOP? MAX,` Response: 3.5E9

- Numerical values are output without a unit. Physical quantities are referred to the basic units or to the units set using the Unit command.

  Example

  `SENSe:FREQuency:CENTer?,` Response: 1E6 (for 1 MHz)

- Truth values <Boolean values> are returned as 0 (for OFF) and 1 (for ON).

  Example

  `SENSe:BANDwidth:AUTO?,` Response: 1 (for ON)

- Text (character data) is returned in a short form.

  Example

  `SYSTem:COMMunicate:SERial:CONTrol:RTS?,` Response `STAN` (for standard)

5.5 Command Sequence and Command Synchronization

What has been said above makes clear that all commands can potentially be carried out overlapping. In order to prevent an overlapping execution of commands, one of the commands *OPC, *OPC? or *WAI must be used. All three commands cause a certain action only to be carried out after the hardware has been set. By suitable programming, the controller can be forced to wait for the respective action to occur (refer to Table 1).

Table 1: Synchronization using *OPC, *OPC? and *WAI

Command	Action	Programming the controller
*OPC	Sets the Operation Complete bit in the ESR after all previous commands have been executed.	– Setting bit 0 in the ESE – Setting bit 5 in the SRE – Waiting for service request (SRQ)
*OPC?	Stops command processing until 1 is returned. This is only the case after the Operation Complete bit has been set in the ESR. This bit indicates that the previous setting has been completed.	Sending *OPC? directly after the command whose processing should be terminated before other commands can be executed.
*WAI	Stops further command processing until all commands sent before *WAI have been executed.	Sending *WAI directly after the command whose processing should be terminated before other commands are executed.

For a couple of commands the synchronization to the end of command execution is mandatory in order to obtain the desired result. The affected commands require either more than one measurement in order to accomplish the desired instrument setting (e.g. auto range functions), or they require a longer period of time for execution. If a new command is received during execution of the corresponding function this may either lead to either to an aborted measurement or to incorrect measurement data.

The following list includes the commands, for which a synchronization via *OPC, *OPC? or *WAI is mandatory:

Table 2: Commands with mandatory synchronization (overlapping commands)

Command	Purpose
INIT	start measurement (sweep)
INIT:CONT OFF	Set to single sweep
CALC:MARK:FUNC:xx?	All Marker function queries

5.6   Remote Control – Commands

The following chapters provide a detailed description of all remote control commands currently available for the R&S FSC and its firmware options.

Each section describes the commands for one of the operating modes available in the R&S FSC, beginning with the description of common commands required to operate the instrument. The structure is based on that of the operating manual.

- Common Commands on page 109

- Remote Commands in Spectrum Mode on page 112

- Remote Commands in Network Analyzer Mode on page 174

- Remote Commands in Power Meter Mode on page 181

Each section is subdivided into various tasks required to perform measurements with the R&S FSC, also based on the structure of the operating manual. Some commands like those for controlling markers or configuring the frequency axis are available for all operating modes. In that case you will find a list of these commands in the corresponding section. However, a detailed description is provided only in the analyzer commands section.

> The spectrum analysis and network analysis modes are implemented in the basic unit. For the other modes, the corresponding options are required.

Following the remote control commands required to perform specific measurements, you will find a description of general commands used to set up and control basic instrument functions. These commands are independent of the operating mode. Therefore they are listed separately.

- Saving and Restoring Instrument Settings and Measurement Results on page 185

- Configuring the Instrument on page 192

- Remote Commands of the Status Reporting System on page 212

All chapters begin with a list of commands available in the context of that chapter. Following that list you will find a detailed description of all commands.

All individual descriptions contain:

- the complete notation and syntax of the command

- the description of the effects of the command

- a list of all parameters available for that command

- an example of how a program message would look like

- the *RST value

- information on SCPI conformity

5.7   Common Commands

The common commands are taken from the IEEE 488.2 (IEC 625-2) standard. A particular command has the same effect on different devices. The headers of these commands consist of an asterisk "*" followed by three letters. Some of the common commands refer to the "Status Reporting System".

List of Common Commands

- *CLS (p. 109)
- *ESE (p. 109)
- *ESR? (p. 109)
- *IDN? (p. 110)
- *IST? (p. 110)
- *OPC (p. 110)
- *OPT? (p. 110)
- *RST (p. 110)
- *SRE (p. 110)
- *STB? (p. 111)
- *TRG (p. 111)
- *TST? (p. 111)
- *WAI (p. 111)

*CLS

> **CLEAR STATUS** sets the status byte (STB), the standard event register (ESR) and the EVENt part of the QUEStionable and the OPERation register to zero. The command does not alter the mask and transition parts of the registers. It clears the output buffer.

*ESE

> **EVENT STATUS ENABLE** sets the event status enable register to the value indicated. The query form *ESE? returns the contents of the event status enable register in decimal form.
>
> **Parameter**
> 0 to 255

*ESR?

> **STANDARD EVENT STATUS QUERY** returns the contents of the event status register in decimal form (0 to 255) and subsequently sets the register to zero.
>
> **Parameter**
> 0 to 255

*IDN?

IDENTIFICATION QUERY queries the instrument identification.

Return values (example)

Example for R&S FSC:
Rohde&Schwarz,FSH4,100005/024,1.30

FSH4	device name
100005/024	serial number/model index
1.30	firmware version

*IST?

INDIVIDUAL STATUS QUERY returns the contents of the IST flag in decimal form. The IST flag is the status bit which is sent during a parallel poll (see chapter "Remote Control - Basics").

Parameter

0 | 1

*OPC

OPERATION COMPLETE sets bit 0 in the event status register after all preceding commands have been executed. This bit can be used to initiate a service request (see chapter "Remote Control - Basics").

*OPT?

OPTION IDENTIFICATION QUERY queries the options included in the instrument and returns a list of the options installed. The options are separated from each other by means of commas.

Parameter

K<number> software options

For a list of all available options and their description refer to the CD-ROM.

Example

K40, K41, K42, K45

*RST

RESET sets the instrument to a defined default status. The command essentially corresponds to pressing the **PRESET** key.

*SRE

SERVICE REQUEST ENABLE sets the service request enable register to the indicated value. Bit 6 (MSS mask bit) remains 0. This command determines under which conditions a service request is generated. The query form *SRE? reads the contents of the service request enable register in decimal form. Bit 6 is always 0.

Parameter

0 to 255

*STB?

READ STATUS BYTE QUERY reads out the contents of the status byte in decimal form.

*TRG

TRIGGER initiates all actions in the currently active test screen expecting a trigger event. This command corresponds to the `INITiate:IMMediate` command. For details refer to the `INITiate[:IMMediate].`

*TST?

SELF TEST QUERY initiates the self test of the instrument and outputs an error code in decimal form.

Parameter
0 = no error

*WAI

WAIT-to-CONTINUE permits servicing of subsequent commands only after all preceding commands have been executed and all signals have settled (see chapter "Remote Control - Basics").

5.8   Remote Commands in Spectrum Mode

This section provides a detailed description of all remote control commands required to configure and perform measurements in Spectrum Analyzer mode.

- Setting the Frequency and the Span on page 112

- Setting Amplitude Parameters on page 116

- Setting the Bandwidths on page 122

- Performing and Triggering the Measurement on page 124

- Working with Traces on page 130

- Using Markers on page 135

- Using Display Lines and Limit Lines on page 148

- Configuring and Using Measurement Functions on page 152

5.8.1   Setting the Frequency and the Span

The following commands configure the frequency axis (x-axis) of the active display.

> **Commands independent of the operating mode**
>
> Note that most of the commands for setting the frequency and span are also valid for other operating modes. If a command is available in another mode, it is indicated by the list in the respective section.

List of commands:

- [SENSe:]CHANnel (p. 113)

- [SENSe:]FREQuency:CENTer (p. 113)

- [SENSe:]FREQuency:CENTer:STEP (p. 113)

- [SENSe:]FREQuency:CENTer:STEP:LINK (p. 113)

- [SENSe:]FREQuency:INPut:MODE (p. 114)

- [SENSe:]FREQuency:MODE (p. 114)

- [SENSe:]FREQuency:OFFSet (p. 114)

- [SENSe:]FREQuency:SPAN (p. 115)

- [SENSe:]FREQuency:SPAN:AUTO (p. 115)

- [SENSe:]FREQuency:SPAN:FULL (p. 115)

- [SENSe:]FREQuency:STARt (p. 115)

- [SENSe:]FREQuency:STOP (p. 116)

[SENSe:]CHANnel

This command defines the channel number if the frequency mode is set ot "channel".

Parameter

<numeric value> = number of the channel to be measured.

Example

```
CHAN 10
```
Measures channel number 10.

Characteristics

*RST value:1
SCPI: conform

[SENSe:]FREQuency:CENTer

This command defines the center frequency or the measuring frequency for span = 0.

Parameter

0 to f_{max}

f_{max} is specified in the data sheet.

Example

```
FREQ:CENT 100MHz
```
Sets the center frequency to 100 MHz.

Characteristics

*RST value: f_{max} /2 with f_{max} = maximum frequency
SCPI: conform

[SENSe:]FREQuency:CENTer:STEP

This command defines the step size of the center frequency.

Parameter

0 to f_{max}

Example

```
FREQ:CENT:STEP 120MHz
```
Sets the step size to 120 MHz.

Characteristics

*RST value: – (AUTO 0.1*SPAN is switched on)
SCPI: conform

[SENSe:]FREQuency:CENTer:STEP:LINK

This command couples the step size of the center frequency to span (span >0) or to the resolution bandwidth (span = 0) or cancels the couplings.

Parameter

DIVTen   Coupling of the step size to 10% of the span

OFF   manual input, no coupling

Example
`FREQ:CENT:STEP:LINK DIVT`
Couples the step size to 10% of the span.

Characteristics
*RST value: DIVTen
SCPI: device-specific

[SENSe:]FREQuency:INPut:MODE

This command selects the frequency mode. Select the Channel frequency mode only if you want to work with channel tables. In this case, the input of the center frequency is not a frequency value, but a channel number.

Parameter
CHANnel | FREQ

Example
`FREQ:INP:MODE CHAN`
Sets the frequency mode to work with channel tables.

Characteristics
*RST value: FREQ
SCPI: device-specific

[SENSe:]FREQuency:MODE

This command switches between span > 0 (SWEep) and zero span (CW | FIXed).

For CW and FIXed, the frequency is set via the `[SENSe:]FREQuency:CENTer` command. In sweep mode, it is via the `[SENSe:]FREQuency:STARt`, `[SENSe:]FREQuency:STOP`, `[SENSe:]FREQuency:CENTer`, and `[SENSe:]FREQuency:SPAN` commands.

Parameter
CW | FIXed | SWEep

Example
`FREQ:MODE SWE`
Activates sweep mode.

Characteristics
*RST value: SWEep
SCPI: conform

[SENSe:]FREQuency:OFFSet

This command defines the frequency offset of the instrument.

Parameter
–100 GHz to 100 GHz

Example
`FREQ:OFFS 1GHZ`
Characteristics
*RST value: 0 Hz
SCPI: conform

[SENSe:]FREQuency:SPAN

This command defines the frequency span.

Parameter

0 to f_{max}

f_{max} is specified in the data sheet.

Example

`FREQ:SPAN 10MHz`

Characteristics

*RST value: f_{max} with f_{max} = maximum frequency
SCPI: conform

[SENSe:]FREQuency:SPAN:AUTO

This command activates and deactivates automatic setting of the span. If the Auto Span is active, the R&S FSC automatically sets the span to best fit the measured channel.

Parameter

ON | OFF

Example

`FREQ:SPAN:AUTO ON`
Activates the Auto Span function

Characteristics

*RST value: OFF
SCPI: device-specific

[SENSe:]FREQuency:SPAN:FULL

This command sets the frequency span to its maximum.

Parameter

f_{max}, specified in the data sheet.

Example

`FREQ:SPAN:FULL`

Characteristics

*RST value: –
SCPI: conform

[SENSe:]FREQuency:STARt

This command defines the start frequency of the analyzer. This command is only available with span > 0.

Parameter

0 to f_{max}

f_{max} is specified in the data sheet.

Example

`FREQ:STAR 20MHz`

Characteristics

*RST value: 0
SCPI: conform

[SENSe:]FREQuency:STOP

This command defines the stop frequency of the analyzer. This command is only available with span > 0.

Parameter

0 to f_{max}

f_{max} is specified in the data sheet.

Example

`FREQ:STOP 2000MHz`

Characteristics

*RST value: f_{max}
SCPI: conform

5.8.2   Setting Amplitude Parameters

The following commands configure the level axis (y-axis) and level parameters of the active display.

> **Commands independent of the operating mode**
>
> Note that some of the commands for setting the level parameters are also valid for other operating modes. If a command is available in another mode, it is indicated by the list in the respective section.

List of commands:

- DISPlay[:WINDow]:TRACe<1...2>:Y:SPACing (p. 117)

- DISPlay[:WINDow]:TRACe<1...2>:Y[:SCALe] (p. 117)

- DISPlay[:WINDow]:TRACe<1...2>:Y[:SCALe]:ADJust (p. 117)

- DISPlay[:WINDow]:TRACe<1...2>:Y[:SCALe]:RLEVel (p. 118)

- DISPlay[:WINDow]:TRACe<1...2>:Y[:SCALe]:RLEVel:OFFSet (p. 118)

- DISPlay[:WINDow]:TRACe<1...2>:Y[:SCALe]:RPOSition (p. 118)

- INPut:ATTenuation (p. 119)

- INPut:ATTenuation:MODE (p. 119)

- INPut:ATTenuation:AUTO (p. 119)

- INPut:GAIN:STATe (p. 120)

- INPut:IMPedance (p. 120)

- [SENSe:]CORRection:TRANsducer<1...2>[:STATe] (p. 120)

- [SENSe:]CORRection:TRANsducer<1...2>:SELect (p. 121)

- [SENSe:]CORRection:TRANsducer<1...2>:UNIT? (p. 121)

- UNIT:POWer (p. 121)

DISPlay[:WINDow]:TRACe<1...2>:Y:SPACing

This command selects the scaling for the level display range.

Parameter

LOGarithmic   Selects logarithmic scaling.

LINear   Selects linear scaling in %.

Example

DISP:TRAC:Y:SPAC LIN
Selects linear scaling of the level axis.

Characteristics

*RST value: LOGarithmic
SCPI: conform

DISPlay[:WINDow]:TRACe<1...2>:Y[:SCALe]

This command defines the display range of a level axis with logarithmic scaling (DISPlay[:WINDow]:TRACe<1...2>:Y:SPACing).

For linear scaling, the display range is fixed and cannot be modified.

The numeric suffix <1...2> is irrelevant.

Parameter

10 dB to 200 dB or value in Hz

Example

DISP:TRAC:Y 110dB
Sets the display range to 110 dB.

Characteristics

*RST value: 100dB
SCPI: device–specific

DISPlay[:WINDow]:TRACe<1...2>:Y[:SCALe]:ADJust

This command automatically sets the scaling of the level axis to best fit the measurement results of the indicated trace.

This command is an event and therefore has no query and no *RST value.

Example

DISP:TRAC:Y:ADJ
Adjusts the y-axis.

Characteristics

*RST value: -
SCPI: device-specific

DISPlay[:WINDow]:TRACe<1...2>:Y[:SCALe]:RLEVel

This command defines the reference level.

With the reference level offset <> 0, the indicated value range of the reference level is modified by the offset.

The unit depends on the setting defined with `UNIT:POWer`.

The numeric suffix <1...2> is irrelevant.

Parameter

<numeric_value> in dBm, range specified in data sheet

Example

`DISP:TRAC:Y:RLEV -60dBm`
Sets the reference level to -60 dBm.

Characteristics

*RST value: –20dBm
SCPI: conform

DISPlay[:WINDow]:TRACe<1...2>:Y[:SCALe]:RLEVel:OFFSet

This command defines the offset of the reference level.

The numeric suffix <1...2> is irrelevant.

Parameter

–200dB to 200dB

Example

`DISP:TRAC:Y:RLEV:OFFS -10dB`

Characteristics

*RST value: 0dB
SCPI: conform

DISPlay[:WINDow]:TRACe<1...2>:Y[:SCALe]:RPOSition

This command defines the position of the reference value. It requires a tracking generator and active normalization in the Tracking Generator mode.

The numeric suffixes <1...2> is irrelevant.

Parameter

0 to 100PCT

Example

`DISP:TRAC:Y:RPOS 50PCT`
Sets the position of the reference value to 50%

Characteristics

*RST value: 100 PCT (Spectrum Analyzer mode)
                 50 PCT (Tracking Generator mode)
SCPI: conform

INPut:ATTenuation

This command programs the input attenuator.

The attenuation can be set in 5 dB steps. If the defined reference level cannot be set for the set RF attenuation, the reference level will be adjusted accordingly.

In the default state with Spectrum Analyzer mode, the attenuation set on the step attenuator is coupled to the reference level of the instrument. If the attenuation is programmed directly, the coupling to the reference level is switched off.

Parameter

<numeric_value> in dB; range specified in data sheet

Example

`INP:ATT 30dB`
Sets the attenuation on the attenuator to 30 dB and switches off the coupling to the reference level.

Characteristics

*RST value: 0 dB (AUTO is set to ON)
SCPI: conform

INPut:ATTenuation:MODE

This command defines the mode for controlling the RF attenuator.

For further information on controlling the RF attenuator refer to the Quick Start Guide, chapter "Controlling the RF Attenuator" or the Operating Manual, chapter "Setting the Amplitude Parameters".

Parameter

LDIStortion | LNOise

Example

`INP:ATT:MODE LNO`
Sets the attenuation mode to Auto Low Noise.

Characteristics

*RST value: LNOise
SCPI: device-specific

INPut:ATTenuation:AUTO

This command automatically couples the input attenuation to the reference level (state ON) or switches the input attenuation to manual entry (state OFF).

Parameter

ON | OFF

Example

`INP:ATT:AUTO ON`
Couples the attenuation set on the attenuator to the reference level.

Characteristics

*RST value: ON
SCPI: conform

INPut:GAIN:STATe

This command switches the preamplifier of the instrument on or off.

Parameter
ON | OFF

Example
`INP:GAIN:STAT ON`
Activates the preamplifier

Characteristics
*RST value: OFF
SCPI: conform

INPut:IMPedance

This command sets the nominal input impedance of the instrument. The set impedance is taken into account in all level indications of results.

The setting 75 Ω should be selected, if the 50 Ω input impedance is transformed to a higher impedance using a 75 Ω adapter of the RAZ type (= 25 Ω in series to the input impedance of the instrument). The correction value in this case is 1.76 dB = 10 log (75Ω / 50Ω).

Parameter
50 | 75

Example
`INP:IMP 75`
Sets the input impedance to 75 Ohm.

Characteristics
*RST value: 50 Ω
SCPI: conform

[SENSe:]CORRection:TRANsducer<1...2>[:STATe]

This command switches the selected transducer factor on or off.

The suffix<1...2> specifies the primary or secondary transducer.

Note: Prior to this command, the [SENSe:]CORRection:TRANsducer<1...2>:SELect command must be sent.

Parameter
ON | OFF

Example
`CORR:TRAN1 ON`
Activates the primary transducer

Characteristics
*RST value: OFF
SCPI: device-specific

[SENSe:]CORRection:TRANsducer<1...2>:SELect

This command selects the transducer factor designated by <name>. If <name> does not exist yet, a new transducer factor is created.

The suffix<1...2> specifies the primary or secondary transducer.

Note: This command must be sent prior to the commands for modifying transducer factors.

Parameter
<string>=Name of the transducer factor in string data form with a maximum of 8 characters.

Example
```
CORR:TRAN1:SEL 'FACTOR1'
```
Selects the 'FACTOR1' as the primary transducer

Characteristics
*RST value: -
SCPI: device-specific

[SENSe:]CORRection:TRANsducer<1...2>:UNIT?

This command queries the unit of the transducer factor in use.

The suffix <1...2> specified the primary or secondary transducer.

Example
```
CORR:TRAN2:UNIT?
```
Queries the unit of the primary transducer.

Characteristics
*RST value: -
SCPI: device-specific

UNIT:POWer

This command selects the default unit.

Parameter
DBM | DBUV | DBMV | V | W | DUVM | DUAM | V_M | W_M2

Example
```
UNIT:POW DBUV
```
Sets the power unit to dBµV.

Characteristics
*RST value: DBM
SCPI: conform

5.8.3   Setting the Bandwidths

The following commands configure the filter bandwidths of the R&S FSC. Note that both groups of commands (BANDwidth and BWIDth) are the same.

ⓘ **Commands independent of the operating mode**

Note that most of the commands for setting the bandwidth are also valid for other operating modes. If a command is available in another mode, it is indicated by the list in the respective section.

List of commands:

- [SENSe:]BANDwidth|BWIDth[:RESolution] (p. 122)

- [SENSe:]BANDwidth|BWIDth[:RESolution]:AUTO (p. 122)

- [SENSe:]BANDwidth|BWIDth:VIDeo (p. 123)

- [SENSe:]BANDwidth|BWIDth:VIDeo:AUTO (p. 123)

[SENSe:]BANDwidth|BWIDth[:RESolution]

This command defines the resolution bandwidth.

Analog resolution filters of 100 Hz to 3 MHz in 1 - 3 - 10 steps are available.

Parameter
1 Hz to 3 MHz

Example
```
BAND 100 kHz
```
Sets the IF bandwidth to 100 kHz

Characteristics
*RST value: – (AUTO is set to ON)
SCPI: conform

[SENSe:]BANDwidth|BWIDth[:RESolution]:AUTO

This command couples the resolution bandwidth to the span or cancels the coupling.

Parameter
ON | OFF

Example
```
BAND:AUTO OFF
```
Switches off the coupling of the resolution bandwidth to the span.

Characteristics
*RST value: ON
SCPI: conform

[SENSe:]BANDwidth|BWIDth:VIDeo

This command defines the instruments video bandwidth.

Parameter
refer to data sheet

Example
`BAND:VID 10kHz`

Characteristics
*RST value: – (AUTO is set to ON)
SCPI: conform

[SENSe:]BANDwidth|BWIDth:VIDeo:AUTO

This command either automatically couples the instruments video bandwidth to the resolution bandwidth or cancels the coupling.

Parameter
ON | OFF

Example
`BAND:VID:AUTO OFF`

Characteristics
*RST value: ON
SCPI: conform

5.8.4 Performing and Triggering the Measurement

5.8.4.1 Performing the Measurement

The following commands initialize a measurement and set up the sweep.

ℹ️ **Commands independent of the operating mode**

Note that most of the commands for performing and triggering measurements are also valid for other operating modes. If a command is available in another mode, it is indicated by the list in the respective section.

List of commands

ABORt

This command aborts a current measurement and resets the trigger system.

Example
```
ABOR;:INIT:IMM
```
Characteristics
RST value: –
SCPI: conform

INITiate[:IMMediate]

The command initiates a new measurement sequence.

With sweep count > 0 or average count > 0, this means a restart of the indicated number of measurements. With trace functions MAXHold, MINHold and AVERage, the previous results are reset on restarting the measurement.

In single sweep mode, synchronization to the end of the indicated number of measurements can be achieved with the command *OPC, *OPC? or *WAI. In continuous–sweep mode, synchronization to the sweep end is not possible since the overall measurement never ends.

This command is an event and therefore has no *RST value and no query.

Example
```
INIT:CONT OFF
```
Switches to single sweep mode.

```
DISP:WIND:TRAC:MODE AVER
```
Activates trace averaging.

```
INIT;*WAI
```
Starts the measurement and waits for the end of the sweep.

Characteristics

*RST value: –
SCPI: conform

INITiate:CONTinuous

This command determines whether the trigger system is continuously initiated (continuous) or performs single measurements (single).

This setting refers to the sweep sequence (switching between continuous/single sweep).

Parameter

ON | OFF

Example

```
INIT:CONT OFF
```
Switches the sequence single sweep.

```
INIT:CONT ON
```
Switches the sequence to continuous sweep.

Characteristics

*RST value: ON
SCPI: conform

[SENSe:]SWEep:COUNt

This command defines the number of sweeps started with single sweep, which are used for calculating the average or maximum value. If the values 0 or 1 are set, one sweep is performed.

Parameter

0 to 999

Example

```
SWE:COUN 64
```
Sets the number of sweeps to 64.

```
INIT:CONT OFF
```
Switches to single sweep mode.

```
INIT;*WAI
```
Starts a sweep and waits for its end.

Characteristics

*RST value: 1
SCPI: conform

[SENSe:]SWEep:POINts?

This command queries the number of measurement points during one sweep.

This command is a query and therefore has no *RST value.

Return value
Number of sweep points.

Example
`SWE:POIN?`
Returns the number of sweep points.

Characteristics
*RST value: –
SCPI: conform

[SENSe:]SWEep:TIME

In analyzer mode, this command defines the sweep time. The available time values vary depending on the span setting.

If `[SENSe:]SWEep:TIME` is directly programmed, automatic coupling to resolution bandwidth and video bandwidth is switched off.

Parameter
Refer to data sheet

Example
`SWE:TIME 10s`
Sets the measurement time to 10 s

Characteristics
*RST value: – (AUTO is set to ON)
SCPI: conform

[SENSe:]SWEep:TIME:AUTO

This command controls the automatic coupling of the sweep time to the frequency span and bandwidth settings.

If `[SENSe:]SWEep:TIME` is directly programmed, automatic coupling is switched off.

Parameter
ON | OFF

Example
`SWE:TIME:AUTO ON`
Switches on the coupling to frequency span and bandwidths.

Characteristics
*RST value: ON
SCPI: conform

5.8.4.2 Triggering Measurements

The following commands set up trigger conditions if you are using a trigger for the measurement.

List of commands

- [SENSe:]SWEep:EGATe (p. 127)
- [SENSe:]SWEep:EGATe:HOLDoff (p. 127)
- [SENSe:]SWEep:EGATe:LENGth (p. 128)
- TRIGger[:SEQuence]:HOLDoff[:TIME] (p. 128)
- TRIGger[:SEQuence]:LEVel:VIDeo (p. 128)
- TRIGger[:SEQuence]:SLOPe (p. 129)
- TRIGger[:SEQuence]:SOURce (p. 129)

[SENSe:]SWEep:EGATe

This command activates or deactivates the gated trigger.

Parameter

ON | OFF

Example

```
SWE:EGAT ON
```
Activates the gated trigger.

Characteristics

*RST value: off

SCPI: device-specific

[SENSe:]SWEep:EGATe:HOLDoff

This command sets the length of the gate delay.

Parameter

0 to 100 s

Example

```
SWE:EGAT:HOLD 2.5
```
Sets a gate delay of 2.5 seconds.

Characteristics

*RST value: 0 s

SCPI: device-specific

[SENSe:]SWEep:EGATe:LENGth

This command sets the gate length.

Parameter

10 µs to 100 s

Example

`SWE:EGAT:LENG 2.5`
Sets a gate length of 2.5 seconds.

Characteristics

*RST value: 400 µs

SCPI: device-specific

TRIGger[:SEQuence]:HOLDoff[:TIME]

This command defines the length of the trigger delay.

Parameter

0 s to +100 s

Example

`TRIG:HOLD 500us`
Sets the trigger delay to 500 µs.

Characteristics

*RST value: 0 s
SCPI: conform

TRIGger[:SEQuence]:LEVel:VIDeo

This command sets the level of the video trigger source. Video triggering is active in Zero Span only.

Parameter

0 to 100 PCT

Example

`TRIG:LEV:VID 50PCT`

Characteristics

*RST value: 50 PCT
SCPI: device–specific

TRIGger[:SEQuence]:SLOPe

This command selects the slope of the trigger signal. The selected trigger slope applies to all trigger signal sources.

Parameter

POSitive | NEGative

Example

`TRIG:SLOP NEG`

Characteristics

*RST value: POSitive
SCPI: conform

TRIGger[:SEQuence]:SOURce

This command selects the trigger source for the start of a sweep.

Parameter

IMMediate (Free Run) | EXTern | VIDeo

Refer to the Operating manual chapter "Setting the Sweep", section "Trigger" for further details on the trigger modes.

Example

`TRIG:SOUR EXT`
Selects the external trigger input as source of the trigger signal

Characteristics

*RST value: IMMediate
SCPI: conform

5.8.5 Working with Traces

The following commands set up the trace and the various functions associated with it, e.g. trace mathematics or the selection of the detector.

Commands independent of the operating mode

Note that most of the commands concerning trace settings are also valid for other operating modes. If a command is available in another mode, it is indicated by the list in the respective section.

List of commands

- CALCulate:MATH<1...2>[:EXPRession][:DEFine] (p. 130)

- CALCulate:MATH<1...2>:COPY:MEMory (p. 131)

- CALCulate:MATH<1...2>:STATe (p. 131)

- DISPlay[:WINDow]:TRACe<1...2>[:STATe] (p. 131)

- DISPlay[:WINDow]:TRACe<1...2>:MODE (p. 132)

- FORMat:BORDer (p. 132)

- [SENSe:]DETector[:FUNCtion] (p. 133)

- [SENSe:]DETector<1...6>[:FUNCtion]:AUTO (p. 133)

- TRACe<1...2>[:DATA]? (p. 133)

- FORMat[:DATA] (p. 134)

CALCulate:MATH<1...2>[:EXPRession][:DEFine]

This command defines the mathematical expression for relating traces to trace1. The trace mathematics are activated with `CALCulate:MATH<1...2>:STATe`.

Parameter

(TRACE–MTRACE) Subtracts the trace in memory from the current trace.

(MTRACE–TRACE) Subtracts the current trace from the trace in memory.

Example

```
CALC:MATH (MTRACE-TRACE)
```
Selects the subtraction of the current trace from trace in the memory.

Characteristics

*RST value: –
SCPI: conform

CALCulate:MATH<1...2>:COPY:MEMory

This command stores the current trace into the memory trace of the R&S FSC.

This command is an event and therefore has no query and no *RST value.

Example

`CALC:MATH:COPY:MEM`
Copies the trace into the memory.

Characteristics

*RST value: -
SCPI: device-specific

CALCulate:MATH<1...2>:STATe

This command switches the mathematical relation of traces on or off.

Parameter

ON | OFF

Example

`CALC:MATH:STAT ON`
Switches on the trace mathematics.

Characteristics

*RST value: OFF
SCPI: conform

DISPlay[:WINDow]:TRACe<1...2>[:STATe]

This command switches on or off the display of the corresponding trace.

Parameter

ON | OFF

Example

`DISP:TRAC2 ON`

Characteristics

*RST value: ON for TRACe1, OFF for TRACe2
SCPI: conform

DISPlay[:WINDow]:TRACe<1...2>:MEMory[:STATe]

This command activates and deactivates the trace stored in the memory of the R&S FSC. The suffix at TRACe selects the memory slot the trace is stored in.

Parameter

ON | OFF

Example

`DISP:TRAC:MEM ON`
Activates memory trace 1.

Characteristics
*RST value: OFF
SCPI: device-specific

DISPlay[:WINDow]:TRACe<1...2>:MODE

This command defines the type of display and the evaluation of the traces. WRITE corresponds to the Clr/Write mode of manual operation. The trace is switched off (= BLANK in manual operation) with `DISPlay[:WINDow]:TRACe<1...2>[:STATe]`.

The number of measurements for AVERage, MAXHold and MINHold is defined with the `[SENSe:]SWEep:COUNt` command. It should be noted that synchronization to the end of the indicated number of measurements is only possible in single sweep mode.

Parameter

WRITe | AVERage | MAXHold | MINHold | VIEW

For details on trace modes refer to the Operating Manual, chapter "Trace Mode".

Example

`SWE:CONT OFF`
Switching to single sweep mode.

`SWE:COUN 16`
Sets the number of measurements to 16.

`DISP:TRAC:MODE MAXH`
Activates MAXHold mode for the trace.

`INIT;*WAI`
Starts the measurement and waits for the end of the 16 sweeps.

Characteristics
*RST value: WRITe
SCPI: device–specific

FORMat:BORDer

This command controls whether binary data is transferred in normal or swapped byte order.

Parameters

SWAPped   The least significant byte is transferred first (little endian)

NORMal   The most significant byte is transferred first (big endian)

Example

`FORM:BORD NORM`
Changes the byte order to normal mode

Characteristics
*RST value SWAPped
SCPI: conform

[SENSe:]DETector[:FUNCtion]

This command selects the detector for recording measured values of the selected trace.

Parameter
APEak | NEGative | POSitive | SAMPle | RMS

For details on detectors refer to the Operating Manual, chapter "Detectors".

Example
`DET POS`
Sets the detector to "positive peak".

Characteristics
*RST value: POS
SCPI: conform

[SENSe:]DETector<1...6>[:FUNCtion]:AUTO

This command either couples the detector to the current trace setting or turns coupling off. The trace is selected by the numeric suffix at DETector.

Parameter
ON | OFF

Example
`DET:AUTO OFF`
Characteristics
*RST value: ON
SCPI: conform

TRACe<1...2>[:DATA]?

This command transfers trace data from the control computer to the instrument, the query reads trace data out of the instrument. The transfer of trace data from the control computer to the instrument takes place by indicating the trace name and then the data to be transferred.

With the FORMat[:DATA] command, you can set the format the trace data is returned in.

Parameter
TRACe1 | LIST

Return values for trace data in Spectrum Analyzer Mode
631 results are returned, one result for each point of the trace. The returned values are scaled in the currently selected unit.

Note: With the auto peak detector, only positive peak values can be read out.

TRACe1 and TRACe2 return the data for trace 1 or trace 2.

LIST queries the peak list of the Spectrum Emission Mask.

Example
`TRAC:DATA? TRACE1`
Reads out the data for trace 1

Characteristics
*RST value: -
SCPI: conform

FORMat[:DATA]

This command sets the data format that is used for transmission of trace data from the R&S FSC to the controlling computer.

Note that the command has no effect for data that you send to the R&S FSC. The R&S FSC automatically recognizes the data it receives, regardless of the format.

Parameter

ASCii   ASCii format, separated by commas

REAL,32   32-bit IEEE 754 floating-point numbers in the "definite length block format"

In REAL,32 format, a string of return values would look like:

```
#42524<value 1><value 2>...<value n>
```

with

#4	Number of digits of the following number of data bytes (= 4 in this example)
2524	Number of following data bytes (2524, corresponds to the 631 sweep points of the R&S FSC.
\<value\>	4-byte floating point value

Example

```
FORM ASC
```
Selects the ASCii data format.

Characteristics

*RST value: ASCii
SCPI: conform

5.8.6   Using Markers

- Markers and Deltamarkers on page 135
- Marker Functions on page 142

5.8.6.1   Markers and Deltamarkers

The following commands are for setting and controlling markers and deltamarkers. If not otherwise noted, the numeric suffix <1...6> at MARKer or DELTamarker select the marker to be controlled.

In Spectrum Analyzer mode, the numeric suffix <1...2> at CALCulate is irrelevant.

> **Commands independent of the operating mode**
>
> Note that most of the commands for using markers are also valid for other operating modes. If a command is available in another mode, it is indicated by the list in the respective section.

List of commands

- CALCulate<1...2>:DELTamarker<1...6>[:STATe] (p. 136)
- CALCulate<1...2>:DELTamarker<1...6>:AOFF (p. 136)
- CALCulate<1...2>:DELTamarker<1...6>:MAXimum[:PEAK] (p. 136)
- CALCulate<1...2>:DELTamarker<1...6>:MAXimum:NEXT (p. 136)
- CALCulate<1...2>:DELTamarker<1...6>:MINimum[:PEAK] (p. 137)
- CALCulate<1...2>:DELTamarker<1...6>:X (p. 137)
- CALCulate<1...2>:DELTamarker<1...6>:X:RELative (p. 137)
- CALCulate<1...2>:DELTamarker<1...6>:Y? (p. 138)
- CALCulate<1...2>:MARKer<1...6>[:STATe] (p. 138)
- CALCulate<1...2>:MARKer<1...6>:AOFF (p. 139)
- CALCulate<1...2>:MARKer<1...6>:MAXimum[:PEAK] (p. 139)
- CALCulate<1...2>:MARKer<1...6>:MAXimum:NEXT (p. 139)
- CALCulate<1...2>:MARKer<1...6>:MINimum[:PEAK] (p. 139)
- CALCulate<1...2>:MARKer<1...6>:X (p. 140)
- CALCulate<1...2>:MARKer<1...6>:X:SLIMits[:STATe] (p. 140)
- CALCulate<1...2>:MARKer<1...6>:X:SLIMits:LEFT (p. 140)
- CALCulate<1...2>:MARKer<1...6>:X:SLIMits:RIGHt (p. 141)
- CALCulate<1...2>:MARKer<1...6>:Y? (p. 141)

CALCulate<1...2>:DELTamarker<1...6>[:STATe]

This command switches the delta marker indicated by the suffix on or off.

The suffix 1 is interpreted as delta marker 2 because the first marker has to be a normal marker. Therefore, using no suffix indicates delta marker 2. If more than one marker (2 to 6) is already active, the command turns these marker into delta markers. If no delta marker is active yet, the command activates the delta marker and positions it on the trace maximum.

Parameter
ON | OFF

Example
CALC:DELT3 ON
Switches marker 3 to delta marker mode.

Characteristics
RST value: OFF
SCPI: device–specific

CALCulate<1...2>:DELTamarker<1...6>:AOFF

This command switches off all active delta markers.

Example
CALC:DELT:AOFF
Switches off all delta markers.

Characteristics
RST value: –
SCPI: device–specific

CALCulate<1...2>:DELTamarker<1...6>:MAXimum[:PEAK]

This command positions the delta marker indicated by the suffix to the current trace maximum. If necessary, the corresponding delta marker is activated first.

This command is an event and therefore has no *RST value and no query.

Example
CALC:DELT3:MAX
Sets delta marker 3 to the maximum value of the associated trace.

Characteristics
RST value: –
SCPI: device–specific

CALCulate<1...2>:DELTamarker<1...6>:MAXimum:NEXT

This command positions the delta marker indicated by the suffix to the next smaller maximum value of the trace. The corresponding delta marker is activated first, if necessary.

This command is an event and therefore has no *RST value and no query.

Example
CALC:DELT2:MAX:NEXT
Sets delta marker 2 to the next smaller maximum value.

Characteristics

RST value: –
SCPI: device–specific

CALCulate<1...2>:DELTamarker<1...6>:MINimum[:PEAK]

This command positions the delta marker indicated by the suffix to the current trace minimum. The corresponding delta marker is activated first, if necessary.

This command is an event and therefore has no *RST value and no query.

Example

`CALC:DELT3:MIN`
Sets delta marker 3 to the minimum value of the associated trace.

Characteristics

RST value: –
SCPI: device–specific

CALCulate<1...2>:DELTamarker<1...6>:X

This command positions the delta marker indicated by the suffix to the specified frequency (span > 0) or time (span = 0). The corresponding delta marker is activated first, if necessary.

Note that it is possible to place the marker outside the visible trace. In that case, this value is invalid.

Parameter

0 to MAX (frequency | sweep time)

Example

`CALC:DELT:MOD REL`
Switches the input for all delta markers to relative to marker 1.

`CALC:DELT2:X 10.7MHz`
Positions delta marker 2 10.7 MHz to the right of marker 1.

`CALC:DELT:X?`
Outputs the absolute frequency/time of delta marker 1.

`CALC:DELT:X:REL?`
Outputs the relative frequency/time of delta marker 1.

Characteristics

RST value: –
SCPI: device–specific

CALCulate<1...2>:DELTamarker<1...6>:X:RELative

This command sets the sets the delta marker indicated by the suffix in relation to marker 1 or the reference position. The command activates the corresponding delta marker, if necessary.

Parameter

Frequency in Hz (span > 0) or time in seconds (span = 0)

Example

`CALC:DELT3:X:REL 5 kHz`
Sets the delta marker at a distance of 5 kHz to the reference position.

Characteristics
RST value: –
SCPI: device–specific

CALCulate<1...2>:DELTamarker<1...6>:Y?

This command queries the measured value of the delta marker indicated by the suffix. The output is always a relative value referred to marker 1. The corresponding delta marker will be activated, if necessary.

To obtain a correct query result, a complete sweep with synchronization to the sweep end must have been performed between the activation of the delta marker and the query of the y value. This is only possible in single sweep mode.

Return value
Depending on the unit defined or on the activated measuring functions, the query result is output in the units below:

Parameter or measuring functions	Output unit
DBM | DBPW | DBUV | DBMV | DBUA	dB (lin/log)
WATT | VOLT | AMPere	dB (lin), % (log)

Example
`INIT:CONT OFF`
Switches to single sweep mode.

`CALC:DELT2 ON`
Switches on delta marker 2.

`INIT;*WAI`
Starts a sweep and waits for its end.

`CALC:DELT2:Y?`
Outputs measurement value of delta marker 2.

Characteristics
RST value: –
SCPI: device–specific

CALCulate<1...2>:MARKer<1...6>[:STATe]

This command switches on or off the currently selected marker. If no indication is made, marker 1 is selected automatically. If marker 2 to 6 is selected and used as a delta marker, it is switched to marker mode.

Parameter
ON | OFF

Example
`CALC:MARK3 ON`
Switches on marker 3 or switches to marker mode.

Characteristics
*RST value: OFF
SCPI: device–specific

CALCulate<1...2>:MARKer<1...6>:AOFF

This command switches off all active markers and all delta markers and active marker/delta marker measurement functions.

This command is an event and therefore has no *RST value and no query.

Example
CALC:MARK:AOFF
Switches off all markers.

Characteristics
*RST value: –
SCPI: device–specific

CALCulate<1...2>:MARKer<1...6>:MAXimum[:PEAK]

This command positions the marker to the current maximum value of the corresponding trace. The corresponding marker is activated first or switched to the marker mode.

This command is an event and therefore has no *RST value and no query.

Example
CALC:MARK2:MAX
Positions marker 2 to the maximum value of the trace.

Characteristics
*RST value: –
SCPI: device–specific

CALCulate<1...2>:MARKer<1...6>:MAXimum:NEXT

This command positions the marker to the next smaller maximum value of the corresponding trace.

This command is an event and therefore has no *RST value and no query.

Example
CALC:MARK2:MAX:NEXT
Positions marker 2 to the next lower maximum value.

Characteristics
*RST value: –
SCPI: device–specific

CALCulate<1...2>:MARKer<1...6>:MINimum[:PEAK]

This command positions the marker to the current minimum value of the corresponding trace. The corresponding marker is activated first or switched to marker mode, if necessary.

This command is an event and therefore has no *RST value and no query.

Example
CALC:MARK2:MIN
Positions marker 2 to the minimum value of the trace.

Characteristics
*RST value: –
SCPI: device–specific

CALCulate<1...2>:MARKer<1...6>:X

This command positions the selected marker to the indicated frequency (span > 0) or time (span = 0). If marker 2 to 6 are selected and used as delta marker, it is switched to marker mode.

Parameter
0 to MAX (frequency | sweep time)

Example
CALC:MARK2:X 10.7MHz
Positions marker 2 to frequency 10.7 MHz.

Characteristics
*RST value: –
SCPI: device–specific

CALCulate<1...2>:MARKer<1...6>:X:SLIMits[:STATe]

This command activates and deactivates marker search limits.

If the power measurement in zero span is active, this command limits the evaluation range on the trace.

The numeric suffix <1...6> is irrelevant for this command.

Parameter
ON | OFF

Example
CALC:MARK:X:SLIM ON
Switches on search limitation.

Characteristics
*RST value: OFF
SCPI: device–specific

CALCulate<1...2>:MARKer<1...6>:X:SLIMits:LEFT

This command sets the left limit of the search range for markers and delta markers. Depending on the span setting of the x–axis the indicated value defines a frequency (span > 0) or time (span = 0).

The numeric suffix <1...6> is irrelevant for this command.

If the power measurement in zero span is active, this command limits the evaluation range to the trace.

Note: The function is only available if the search limit for marker and delta marker is switched on (CALCulate<1...2>:MARKer<1...6>:X:SLIMits[:STATe]).

Parameter
0 to MAX (frequency | sweep time)

Example

CALC:MARK:X:SLIM ON
Switches the search limit function on.

CALC:MARK:X:SLIM:LEFT 10MHz
Sets the left limit of the search range to 10 MHz.

Characteristics

*RST value: – (is set to the left diagram border when switching on search limits)
SCPI: device–specific

CALCulate<1...2>:MARKer<1...6>:X:SLIMits:RIGHt

This command sets the right limit of the search range for markers and delta markers. Depending on the span setting of the x–axis the indicated value defines a frequency (span > 0) or time (span = 0).

The numeric suffix <1...6> is irrelevant for this command.

If the power measurement in zero span is active, this command limits the evaluation range to the trace.

Note: The function is only available if the search limit for marker and delta marker is switched on (CALCulate<1...2>:MARKer<1...6>:X:SLIMits[:STATe]).

Parameter

0 to MAX (frequency | sweep time)

Example

CALC:MARK:X:SLIM ON
Switches the search limit function on.

CALC:MARK:X:SLIM:RIGH 20MHz
Sets the right limit of the search range to 20 MHz.

Characteristics

*RST value: – (is set to the right diagram border when switching on search limits)
SCPI: device–specific

CALCulate<1...2>:MARKer<1...6>:Y?

This command queries the measured value of the selected marker. The corresponding marker is activated before or switched to marker mode, if necessary.

To obtain a correct query result, a complete sweep with synchronization to the sweep end must be performed between the activation of the marker and the query of the Y value. This is only possible in single sweep mode.

Return values

Numeric value of the marker position, the unit depends on currently set unit (see UNIT:POWer).

Example

INIT:CONT OFF
Switches to single sweep mode.

CALC:MARK2 ON
Switches marker 2.

INIT;*WAI
Starts a sweep and waits for the end.

```
CALC:MARK2:Y?
```
Outputs the measured value of marker 2.

Characteristics
*RST value: –
SCPI: device–specific

5.8.6.2 Marker Functions

The following commands perform various kinds of analysis at the marker position.

List of commands

- CALCulate:MARKer<1...6>:COUNt[:STATe] (p. 142)

- CALCulate:MARKer<1...6>:COUNt:FREQuency? (p. 143)

- CALCulate:MARKer<1...6>:FREQuency:MODE (p. 143)

- CALCulate:MARKer<1...6>:FUNCtion:CENTer (p. 144)

- CALCulate:MARKer<1...6>:FUNCtion:DEModulation[:STATe] (p. 144)

- CALCulate:MARKer<1...6>:FUNCtion:DEModulation:HOLDoff (p. 144)

- CALCulate:MARKer<1...6>:FUNCtion:DEModulation:SELect (p. 145)

- CALCulate:MARKer<1...6>:FUNCtion:NDBDown:STATe (p. 145)

- CALCulate:MARKer<1...6>:FUNCtion:NDBDown (p. 145)

- CALCulate:MARKer<1...6>:FUNCtion:NDBDown:FREQuency? (p. 146)

- CALCulate:MARKer<1...6>:FUNCtion:NDBDown:RESult? (p. 146)

- CALCulate:MARKer<1...6>:FUNCtion:NOISe[:STATe] (p. 146)

- CALCulate:MARKer<1...6>:FUNCtion:NOISe:RESult? (p. 147)

- CALCulate:MARKer<1...6>:FUNCtion:REFerence (p. 147)

CALCulate:MARKer<1...6>:COUNt[:STATe]

This command switches on or off the frequency counter at the marker position.

The count result is queried with CALCulate:MARKer<1...6>:COUNt:FREQuency?.

Frequency counting is possible only for one marker at a time. If it is activated for another marker, it is automatically deactivated for the previous marker.

It should be noted that a complete sweep must be performed after switching on the frequency counter to ensure that the frequency to be measured is actually reached. The synchronization to the sweep end required for this is only possible in single sweep mode.

Parameter
ON | OFF

Example
```
INIT:CONT OFF
```
Switches to single sweep mode.

```
CALC:MARK ON
```
Switches on marker 1.

`CALC:MARK:COUN ON`
Switches on the frequency counter for marker 1.

`INIT;*WAI`
Starts a sweep and waits for the end.

`CALC:MARK:COUN:FREQ?`
Outputs the measured value.

Characteristics
*RST value: OFF
SCPI: device–specific

CALCulate:MARKer<1...6>:COUNt:FREQuency?

This command performs a frequency measurement at the position of the marker indicated by the suffix at MARKer and returns the result. Before the command, the frequency counter should be switched on and a complete measurement performed to obtain a correct count result. Therefore, a single sweep with synchronization must be performed between switching on the frequency counter and querying the count result.

This command is only a query and therefore has no *RST value.

Example
`INIT:CONT OFF`
Switches to single sweep mode.

`CALC:MARK2 ON`
Switches on marker 2.

`CALC:MARK2:COUN ON`
Switches the frequency counter for marker 2.

`INIT;*WAI`
Starts a sweep and waits for the end.

`CALC:MARK2:COUN:FREQ?`
Outputs the measured value of marker 2.

Characteristics
*RST value: –
SCPI: device–specific

CALCulate:MARKer<1...6>:FREQuency:MODE

This command sets the marker frequency display mode.

Parameter
FREQ | CHAN

Example
`CALC:MARK:FREQ:MODE FREQ`
Selects the frequency display mode.

Characteristics
*RST value: FREQ
SCPI: device-specific

CALCulate:MARKer<1...6>:FUNCtion:CENTer

This command matches the center frequency to the frequency of the marker indicated by the suffix at MARKer. If you select a delta marker, it is turned into a normal marker.

This command is an event and therefore has no *RST value and no query.

The numeric suffix at CALCulate is irrelevant.

Example

`CALC:MARK1:FUNC:CENT`
Matches the center frequency to the frequency of marker 1.

Characteristics

*RST value: -
SCPI: device-specific

CALCulate:MARKer<1...6>:FUNCtion:DEModulation[:STATe]

This command switches on or off the audio demodulator when the indicated marker is reached. With span > 0 the hold time can be defined at the corresponding marker position with `CALCulate:MARKer<1...6>:FUNCtion:DEModulation:HOLDoff`. In zero span the demodulation is permanently active.

Parameter

ON | OFF

Example

`CALC:MARK3:FUNC:DEM ON`
Switches on the demodulation for marker 3.

Characteristics

*RST value: OFF
SCPI: device–specific

CALCulate:MARKer<1...6>:FUNCtion:DEModulation:HOLDoff

This command defines the hold time at the marker position for the demodulation with span > 0. The setting is independent of the selected marker, the suffixes and <1...6> are irrelevant.

Parameter

10ms to 500s

Example:

`CALC:MARK:FUNC:DEM:HOLD 3s`

Characteristics:

*RST value: – (DEModulation is set to OFF)
SCPI: device–specific

CALCulate:MARKer<1...6>:FUNCtion:DEModulation:SELect

This command selects the demodulation type for the audio demodulator. The command is independent of the selected marker, the suffixes 1 to 6 are irrelevant.

Parameter

AM | FM

Example

CALC:MARK:FUNC:DEM:SEL FM

Characteristics

*RST value: AM
SCPI: device–specific

CALCulate:MARKer<1...6>:FUNCtion:NDBDown:STATe

This command activates and deactivates the n dB Down marker function. The n dB down function sets two temporary markers n dB below the level of the reference marker (marker 1), one on the right and the other marker to the left of the reference marker.

The command is independent of the selected marker, the suffixes 1 to 6 are irrelevant.

Parameter

ON | OFF

Example

CALC:MARK:FUNC:NDBD:STAT ON
Activates the n dB down marker function.

Characteristics

*RST value: OFF
SCPI: device-specific

CALCulate:MARKer<1...6>:FUNCtion:NDBDown

This command defines the distance in dB of the two temporary n dB down markers to the reference marker.

The command is independent of the selected marker, the suffixes 1 to 6 are irrelevant.

Example

CALC:MARK:FUNC:NDBDown 9
Sets the two temporary markers 9 dB below the reference marker.

Characteristics

*RST value: 3 dB
SCPI: device-specific

CALCulate:MARKer<1...6>:FUNCtion:NDBDown:FREQuency?

This command queries the frequencies of the two temporary n dB down markers.

The command is independent of the selected marker, the suffixes 1 to 6 are irrelevant.

Return values

<frequency1>   absolute frequency of the n dB marker to the left of the reference marker in Hz.

<frequency2>   absolute frequency of the n dB marker to the right of the reference marker in Hz.

Example

CALC:MARK:FUNC:NDBD:FREQ?
This command would return, for example, 100000000, 200000000, meaning that the first marker position is at 100 MHz, the second marker position is at 200 MHz

Characteristics

*RST value: -
SCPI: device-specific

CALCulate:MARKer<1...6>:FUNCtion:NDBDown:RESult?

This command queries the frequency spacing or bandwidth of the two temporary n dB down markers.

The command is independent of the selected marker, the suffixes 1 to 6 are irrelevant.

Return value

Bandwidth in Hz.

Example

CALC:MARK:FUNC:NDBD:RES?

Characteristics

*RST value: -
SCPI: device-specific

CALCulate:MARKer<1...6>:FUNCtion:NOISe[:STATe]

This command switches the noise measurement on or off for all markers. The noise power density is measured at the position of the markers. The result can be queried with
CALCulate:MARKer<1...6>:FUNCtion:NOISe:RESult?.

Parameter

ON | OFF

Example

CALC:MARK:FUNC:NOIS ON
Switches on the noise measurement.

Characteristics

*RST value: OFF
SCPI: device–specific

CALCulate:MARKer<1...6>:FUNCtion:NOISe:RESult?

This command queries the result of the noise measurement.

A complete sweep with synchronization to the sweep end must be performed between switching on the function and querying the measured value in order to obtain a correct query result. This is only possible in single sweep mode.

This command is an event and therefore has no *RST value and no query.

Return value
Noise level, the unit depends on the unit set with `UNIT:POWer`.

Example
`INIT:CONT OFF`
Switches to single sweep mode.

`CALC:MARK2 ON`
Switches on marker 2.

`CALC:MARK2:FUNC:NOIS ON`
Switches on noise measurement for marker 2.

`INIT;*WAI`
Starts a sweep and waits for the end.

`CALC:MARK2:NOIS:RES?`
Outputs the noise result of marker 2.

Characteristics
*RST value: –
SCPI: device–specific

CALCulate:MARKer<1...6>:FUNCtion:REFerence

This command matches the reference level to the power of the marker indicated by the suffix at MARKer. If you select a delta marker, it is turned into a normal marker.

This command is an event and therefore has no *RST value and no query.

The numeric suffix at CALCulate is irrelevant.

Example
`CALC:MARK1:FUNC:REF`
Matches the reference level to the power level of marker 1.

Characteristics
*RST value: -
SCPI: device-specific

5.8.7　Using Display Lines and Limit Lines

5.8.7.1　Display Lines

The following commands define the position of the display line.

List of commands

- CALCulate<1...2>:DLINe
- CALCulate<1...2>:DLINe:STATe

CALCulate<1...2>:DLINe

This command defines the position of the display line indicated by the suffix. The display line can be used to mark any level in the diagram.

The command accepts a variety of units which enables you to express a display line position in a preferred unit without the need to adapt to the instrument's current unit. Omitting a unit uses instrument's current unit.

Parameter

MINimum to MAXimum (depending on current unit)

Example

```
CALC:DLIN –20dBm
```

Characteristics

*RST value: – (STATe to OFF)
SCPI: device–specific

CALCulate<1...2>:DLINe:STATe

This command switches the display line on or off.

Parameter

ON | OFF

Example

```
CALC:DLIN2:STAT OFF
```

Characteristics

*RST value: OFF
SCPI: device–specific

5.8.7.2   Limit Lines

The following commands define limit lines and perform the corresponding limit checks.

List of commands

- CALCulate<1...2>:LIMit<1...2>:BEEP[:STATe]

- CALCulate<1...2>:LIMit<1...2>:COMMent?

- CALCulate<1...2>:LIMit<1...2>:DELete

- CALCulate<1...2>:LIMit<1...2>:FAIL?

- CALCulate<1...2>:LIMit<1...2>:LOWer:SELect

- CALCulate<1...2>:LIMit<1...2>:STATe

- CALCulate<1...2>:LIMit<1...2>:UNIT:X?

- CALCulate<1...2>:LIMit<1...2>:UNIT[:Y]?

- CALCulate<1...2>:LIMit<1...2>:UPPer:SELect

CALCulate<1...2>:LIMit<1...2>:BEEP[:STATe]

This command activates or deactivates the audio beep. If active, the R&S FSC outputs a beep each time a limit is exceeded.

The numeric suffix <1...2> is irrelevant.

Parameter
ON | OFF

Example
CALC:LIM:BEEP ON
Activates the audio beep.

Characteristics
*RST value: OFF
SCPI: device-specific

CALCulate<1...2>:LIMit<1...2>:COMMent?

This command queries the description of the limit line indicated by the numeric suffix <1...2>.
The maximum number of characters for the comment is 32.

This command is a query and therefore has no RST value.

Return value
<string> = description of the limit line.

Example
CALC:LIM:COMM?
Queries the description of limit line 1.

Characteristics
*RST value: -
SCPI: device-specific

CALCulate<1...2>:LIMit<1...2>:DELete

This command deletes the limit line indicated by the suffix.

This command is an event and therefore has no *RST value and no query.

Example

CALC:LIM2:DEL
Deletes the second limit line

Characteristics

*RST value: -
SCPI: device-specific

CALCulate<1...2>:LIMit<1...2>:FAIL?

This command queries the result of the limit check of the limit line indicated by the suffix.

Note that a complete sweep must have been performed to obtain a correct result. A synchronization with *OPC, *OPC? or *WAI should therefore be provided. The result of the limit check is given with 0 for PASS, 1 for FAIL.

Return Values

0 for PASS and 1 for FAIL

Example

INIT;*WAI
Starts a new sweep and waits for its end.

CALC:LIM1:FAIL?
Queries the result of the check for limit line 1.

Characteristics

*RST value: -
SCPI: conform

CALCulate<1...2>:LIMit<1...2>:LOWer:SELect

This command selects the lower limit line.

This command is an event and therefore has no *RST value and no query.

Parameter

<string> = file name of the limit line

Example

CALC:LIM:LOW:SEL 'LINE1'
Selects the limit line with the name LINE1 as the lower limit line.

Characteristics

*RST value:
SCPI: conform

CALCulate<1...2>:LIMit<1...2>:STATe

This command activates and deactivates the limits.

The result of the limit check can be queried with CALCulate<1...2>:LIMit<1...2>:FAIL?.

Parameter
ON | OFF

Example
CALC:LIM:STAT ON
Switches on the limit check for limit line 1.

Characteristics
*RST value: OFF
SCPI: conform

CALCulate<1...2>:LIMit<1...2>:UNIT:X?

This command queries the unit of the x-axis.

This command is a query and therefore has no *RST value.

Example
CALC:LIM:UNIT:X?
Queries the x-unit of the first limit line.

Characteristics
*RST value: -
SCPI: device-specific

CALCulate<1...2>:LIMit<1...2>:UNIT[:Y]?

This command queries the unit of the level axis (y-unit).

This command is a query and therefore has no *RST value.

Example
CALC:LIM1:UNIT?
Queries the y-unit of the first limit line.

Characteristics
*RST value: -
SCPI: device-specific

CALCulate<1...2>:LIMit<1...2>:UPPer:SELect

This command selects the upper limit line.

This command is an event and therefore has no *RST value and no query.

Parameter

<string>

with <string> = file name of the limit line.

Example

```
CALC:LIM:UPP:SEL 'LINE2'
```
Selects the limit line with the name LINE2 as the upper limit line

Characteristics

*RST value: -
SCPI: conform

5.8.8 Configuring and Using Measurement Functions

The R&S FSC provides measurement functions which allow you to perform advanced measurements and can also be controlled remotely.

General measurement functions:

- Working with Channel Tables on page 153

Power measurements:

- Power Measurements on page 153
- Measuring the Channel Power on page 156
- Measuring the Occupied Bandwidth on page 158
- TDMA Measurements on page 159
- Measuring the Adjacent Channel on page 159

Other measurements

- Measuring the Harmonic Distortion on page 169
- Measuring the AM Modulation Depth on page 171

5.8.8.1   Working with Channel Tables

Use the following commands to work with channel tables.

List of commands

- [SENSe:]CHANnel:TABLe:SELect (p. 153)

[SENSe:]CHANnel:TABLe:SELect

This command selects the specified channel table for future measurements.

This command is an event and therefore has no query and no *RST value.

Parameter
<string>

Example
CHAN:TABL:SEL 'CATV.CHNTAB'
Loads the channel table with the name CATV.

Characteristics
*RST value: -
SCPI: device-specific

5.8.8.2   Power Measurements

The following commands configure power measurements. To perform the actual measurement, use the commands described in section "Performing and Triggering the Measurement".

List of commands

- CALCulate:MARKer:FUNCtion:POWer:SELect (p. 154)

- CALCulate:MARKer:FUNCtion:POWer[:STATe] (p. 154)

- CALCulate:MARKer:FUNCtion:POWer:PRESet (p. 154)

- CALCulate:MARKer:FUNCtion:POWer:PRESet:CHECk? (p. 155)

- CALCulate:MARKer:FUNCtion:LEVel:ONCE (p. 155)

- CALCulate:MARKer:FUNCtion:POWer:RESult? (p. 155)

CALCulate:MARKer:FUNCtion:POWer:SELect

This command selects the power measurement setting for a standard and previously switches on the corresponding measurement, if required.

The configuration for a standard comprises of the parameters weighting filter, channel bandwidth and spacing, resolution and video bandwidth, as well as detector and sweep time.

Parameter

CPOWer	Channel power measurement
ACPower	ACP / ACLR measurement
OBANdwidth | OBWidth	Measurement of occupied bandwidth
TDMA	Measurement on TDMA signals

Example

```
CALC:MARK:FUNC:POW:SEL CPOW
```
Selects the channel power measurement

Characteristics
*RST value: –
SCPI: device–specific

CALCulate:MARKer:FUNCtion:POWer[:STATe]

This command activates and deactivates the selected power measurement.

This command is an event and therefore has no *RST value.

Parameter
ON | OFF

Example

```
CALC:MARK:FUNC:POW OFF
```
Switches off the power measurement.

Characteristics
*RST value: –
SCPI: device–specific

CALCulate:MARKer:FUNCtion:POWer:PRESet

This command loads and initializes a predefined Standard from the specified file, and switches to the corresponding measurement mode. A Standard comprises of parameters specifying default values for settings related to power measurements. Parameters such as channel bandwidth, resolution bandwidth, detector type, and sweep time are examples of parameters stored in a Standard.

Parameter
<string> = file name of the standard

Example

```
CALC:MARK:FUNC:POW:PRES 'cdma.std'
```
Selects the file CDMA.STD for the measurement.

Characteristics
*RST value: -
SCPI: device-specific

CALCulate:MARKer:FUNCtion:POWer:PRESet:CHECk?

This command determines whether the current instrument state is still in compliance with the Standard currently in use. Modifying instrument settings that are not included in a Standard do not break Standard compliance; modifying settings that are included in a Standard, will break compliance.

This command is a query and therefore has no *RST value.

Return Values

0　　　　　　Instrument Settings are not compliant to the selected standard.

1　　　　　　Instrument settings are compliant to the selected standard.

Example

CALC:MARK:FUNC:POW:PRES:CHEC?
Queries compliance to the standard currently in use.

Characteristics
*RST value: -
SCPI: device-specific

CALCulate:MARKer:FUNCtion:LEVel:ONCE

This command adjusts the reference level of the R&S FSC to the measured power.

This ensures that the RF attenuation and reference level are optimally adjusted to the signal level without overloading the R&S FSC or limiting the dynamic range by too small a S/N ratio.

Current measurements are aborted when pressing the softkey to run a series of test sweeps. The actual measurements are resumed after the automatic level detection is finished.

Example

CALC:MARK:FUNC:LEV:ONCE

Characteristics
*RST value: -
SCPI: device–specific

CALCulate:MARKer:FUNCtion:POWer:RESult?

This command queries the result of the performed power measurement. If necessary, the measurement is switched on prior to the query.

To obtain a correct result, a complete sweep with synchronization to the end of the sweep must be performed before a query is output. Synchronization is possible only in the single sweep mode.

This command is a query and therefore has no *RST value.

Parameter and return values

CPOWer　　　　　　　　　Channel power measurement

　　　　　　　　　　　　　With logarithmic scaling (RANGE LOG), the channel power is output in the currently selected level unit; with linear scaling (RANGE LIN dB or LIN %), the channel power is output in W.

OBANdwidth	OBWidth	Measurement of occupied bandwidth
	The occupied bandwidth in Hz is returned.
TDMA	TDMA measurement.
	Returns the power of the TDMA signal.

Example of occupied bandwidth measurement

`POW:BAND 90PCT`
Defines 90% as the percentage of the power to be contained in the bandwidth range to be measured.

`INIT:CONT OFF`
Switches over to single sweep mode.

`INIT;*WAI`
Starts a sweep and waits for the end of the sweep.

`CALC:MARK:FUNC:POW:RES? OBW`
Queries the occupied bandwidth measured.

Characteristics
*RST value: –
SCPI: device–specific

5.8.8.3   Measuring the Channel Power

The following commands configure channel power measurements. To perform the actual measurement, use the commands described in section "Performing and Triggering the Measurement".

Note that the numeric suffix <1…6> at MARKer is irrelevant when using these commands.

List of commands

- CALCulate:MARKer<1...6>:FUNCtion:CPOWer:BANDwidth (p. 156)

- CALCulate:MARKer<1...6>:FUNCtion:CPOWer:MODE (p. 157)

- CALCulate:MARKer<1...6>:FUNCtion:CPOWer:UNIT (p. 157)

CALCulate:MARKer<1...6>:FUNCtion:CPOWer:BANDwidth

This command sets the channel bandwidth for channel power measurements.

The numeric suffix <1...6> is irrelevant.

Parameter
<numeric> | UP | DOWN

Example
`CALC:MARK:FUNC:CPOW:BAND 4 MHZ`
Sets the channel bandwidth to 4 MHz.

Characteristics
*RST value: 3.84 MHz
SCPI: device-specific

CALCulate:MARKer<1...6>:FUNCtion:CPOWer:MODE

This command sets the power display mode to Clear / Write or Max Hold for channel power measurements.

The numeric suffix <1...6> is irrelevant.

Parameter
CLR | MAX

Example
CALC:MARK:FUNC:CPOW:MODE CLR
Selects clear/write trace mode

Characteristics
*RST value: CLR
SCPI: device-specific

CALCulate:MARKer<1...6>:FUNCtion:CPOWer:UNIT

This command defines the unit for channel power measurements.

The numeric suffix <1...6> is irrelevant.

Parameter
DBM | DBMV | DBUV | VOLT | WATT | DUVM | DUAM | V | W | V_M | W_M2

Example
CALC:MARK:FUNC:CPOW:UNIT DBM
Sets the unit to dBm.

Characteristics
*RST value: dBm
SCPI: device-specific

5.8.8.4   Measuring the Occupied Bandwidth

The following commands configure the measurement of the Occupied Bandwidth. To perform the actual measurement, use the commands described in section "Performing and Triggering the Measurement".

List of commands

- CALCulate:MARKer<1...6>:FUNCtion:OBAN|OBW:BANDwidth (p. 158)

- CALCulate:MARKer<1...6>:FUNCtion:OBAN|OBW:BANDwidth:PCT (p. 158)

CALCulate:MARKer<1...6>:FUNCtion:OBAN|OBW:BANDwidth

This command sets the channel bandwidth for occupied bandwidth measurements.

Parameter
<numeric>

Example
CALC:MARK:FUNC:OBW:BAND 1 MHZ
Sets the channel bandwidth to 1 MHz

Characteristics
*RST value: 3.84 MHz
SCPI: device-specific

CALCulate:MARKer<1...6>:FUNCtion:OBAN|OBW:BANDwidth:PCT

This command sets the percentage of the total power that defines the occupied bandwidth.

Parameter
10 to 99

Example
CALC:MARK:FUNC:OBW:BAND:PCT 95
Sets the power percentage to 95%

Characteristics
*RST value: 99%
SCPI: device-specific

5.8.8.5   TDMA Measurements

The following commands configure TDMA measurements. To perform the actual measurement, use the commands described in section "Performing and Triggering the Measurement".

List of commands

- CALCulate:MARKer<1...6>:FUNCtion:TDMA:BURSt (p. 159)

CALCulate:MARKer<1...6>:FUNCtion:TDMA:BURSt

This command sets the burst length of the TDMA signal.

Parameter

31.7 us to 19 ms

Example

`CALC:MARK:FUNC:TDMA:BURS 80 US`
Sets the burst length to 80 us.

Characteristics

*RST value: 470 us
SCPI: device-specific

5.8.8.6   Measuring the Adjacent Channel Leakage Ratio

The following commands configure Adjacent Channel Power measurements. To perform the actual measurement, use the commands described in section "Performing and Triggering the Measurement".

- Configuring and Performing the ACLR Measurement on page 159
- Adjacent Channel Power Limit Check on page 164

Configuring and Performing the ACLR Measurement

The following commands are for configuring and performing the adjacent channel power measurement.

List of commands

- [SENSe:]POWer:ACHannel:ACPairs (p. 160)
- [SENSe:]POWer:ACHannel:BANDwidth[:CHANnel (p. 160)
- [SENSe:]POWer:ACHannel:BANDwidth:ACHannel (p. 160)
- [SENSe:]POWer:ACHannel:BANDwidth:ALTernate<1...11> (p. 161)
- [SENSe:]POWer:ACHannel:MODE (p. 161)
- [SENSe:]POWer:ACHannel:PRESet:RLEVel (p. 161)
- [SENSe:]POWer:ACHannel:REFerence:TXCHannel:AUTO (p. 162)
- [SENSe:]POWer:ACHannel:REFerence:TXCHannel:MANual (p. 162)
- [SENSe:]POWer:ACHannel:SPACing[:ACHannel] (p. 163)
- [SENSe:]POWer:ACHannel:SPACing:ALTernate<1...11> (p. 163)
- [SENSe:]POWer:ACHannel:SPACing:CHANnel<1...11> (p. 163)
- [SENSe:]POWer:ACHannel:TXCHannel:COUNt (p. 164)

[SENSe:]POWer:ACHannel:ACPairs

This command sets the number of adjacent channels pair to the left and to the right of the Tx channel.

Parameter

1 to 12

Example

`POW:ACH:ACP 3`

Sets 3 adjacent or alternate channels to the left and to the right of the transmission channel.

Characteristics

*RST value: 1
SCPI: device-specific

[SENSe:]POWer:ACHannel:BANDwidth[:CHANnel

This command sets the channel bandwidth of the radio communication system. The bandwidths of adjacent channels are not influenced by this command.

Instead of BANDwidth, you can also use the alias BWIDth

Parameter

100 Hz to 1000 MHz

Example

`POW:ACH:BAND 120 KHZ`

Sets the bandwidth to 120 kHz

Characteristics

*RST value: 14 kHz
SCPI: device-specific

[SENSe:]POWer:ACHannel:BANDwidth:ACHannel

This command sets the channel bandwidth of the adjacent channel in the radio communication system. If you change the bandwidth of the adjacent channel, the bandwidth of all other alternate channels is adjusted to the same value.

Instead of BANDwidth, you can also use the alias BWIDth

Parameter

100 Hz to 1000 MHz

Example

`POW:ACH:BAND:ACH 120 KHZ`

Sets the bandwidth of the adjacent channel to 120 kHz

Characteristics

*RST value: 14 kHz
SCPI: device-specific

[SENSe:]POWer:ACHannel:BANDwidth:ALTernate<1...11>

This command sets the bandwidth of the alternate channels in the radio communication system. If you change the bandwidth of the first alternate channel, the bandwidth of all other alternate channels is adjusted to the same value.

The suffix <1...11> selects the number of the alternate channel.

Instead of BANDwidth, you can also use the alias BWIDth

Parameter
100 Hz to 1000 MHz

Example
POW:ACH:BAND:ALT2 120 KHZ
Sets the bandwidth of the second alternate channel to 120 kHz

Characteristics
*RST value: 14 kHz
SCPI: device-specific

[SENSe:]POWer:ACHannel:MODE

This command selects either absolute or relative adjacent channel measurements. The command is available if span > 0 and if the number of adjacent channel is greater than 0.

Parameter
ABSolute | RELative

Example
POW:ACH:MODE ABS
Performs an absolute ACP measurement.

Characteristics
*RST value
SCPI: device-specific

[SENSe:]POWer:ACHannel:PRESet:RLEVel

This command adjust the reference level to that of the currently measured channel power. It also initiates an adjacent channel power measurement.

This ensures that the signal path of the instrument is not overloaded. Since the measurement bandwidth is significantly smaller than the signal bandwidth in channel power measurements, the signal path can be overloaded although the trace is still significantly below the reference level. If the measured channel power equals the reference level, the signal path is not overloaded.

This command is an event and therefore has no *RST value and no query.

Example
POW:ACH:PRES:RLEV
Initiates an ACP measurement and adjusts the reference level.

Characteristics
*RST value: -
SCPI: device-specific

[SENSe:]POWer:ACHannel:REFerence:TXCHannel:AUTO

This command activates the automatic selection of a transmission channel to be used as a reference channel in relative ACP measurements.

You can define the Tx channel with the highest power, the lowest power, or the Tx channel nearest to the adjacent channels as the reference channel.

The command is available only for multi-carrier channel and adjacent-channel power measurements with span > 0

Parameter

MINimum   Tx channel with the lowest power

MAXimum   Tx channel with the highest power

LHIGhest   Lowest Tx channel for lower adjacent channels and highest Tx channel for upper adjacent channels

Example

POW:ACH:REF:TXCH:AUTO MIN

Sets the TX channel with the lowest power as reference channel

Characteristics

*RST value
SCPI: device-specific

[SENSe:]POWer:ACHannel:REFerence:TXCHannel:MANual

This command defines a transmission channel as the reference channel for relative ACP measurements.

The command is available only for multi-carrier channel and adjacent-channel power measurements with span > 0

Parameter

1 to 12

Example

POW:ACH:REF:TXCH:MAN 2
Sets the second Tx channel as reference channel.

Characteristics

*RST value: 1
SCPI: device-specific

[SENSe:]POWer:ACHannel:SPACing[:ACHannel]

This command sets the spacing between the carrier and its adjacent channel.

A change of the adjacent channel spacing causes a change in the spacing of all alternate channels above the adjacent channel.

Parameter
100 Hz to 2000 MHz

Example
POW:ACH:SPAC 10 KHZ
Defines a channel spacing of the adjacent channel of 10 kHz

Characteristics
*RST value: 14 kHz
SCPI: device-specific

[SENSe:]POWer:ACHannel:SPACing:ALTernate<1...11>

This command sets the spacing between transmission channel and the alternate channels. A change of the alternate channel spacing causes a change in the spacing of all alternate channels above the modifed alternate channel. Alternate channels below the modified remain the same.

The numeric suffix <1...11> at ALTernate selects the alternate channel.

Parameter
100 Hz to 2000 MHz

Example
POW:ACH:SPAC:ALT2 20 KHZ
Defines a channel spacing of the second alternate channel to the transmission channel of 20 kHz.

Characteristics
*RST value: ALT1: 40 kHz; ALT2: 60 kHz; ALT3: 80 kHz etc.
SCPI: device-specific

[SENSe:]POWer:ACHannel:SPACing:CHANnel<1...11>

This command defines the channel spacing of the transmission channels.

The numeric suffix <1...11> at CHANnel selects the TX channel.

Parameter
14 kHz to 2000 MHz

Example
POW:ACH:SPAC:CHAN2 20 kHz

Defines a channel spacing of the second Tx channel of 14 kHz

Characteristics
*RST value: 20 kHz
SCPI: device-specific

[SENSe:]POWer:ACHannel:TXCHannel:COUNt

This command sets the number of transmission channels.

The command is available for measurements with span > 0.

Parameter

1 to 12

Example

POW:ACH:TXCH:COUN 2
Sets 2 Tx channels.

Characteristics

*RST value: 1
SCPI: device-specific

Adjacent Channel Power Limit Check

The following commands configure and perform limit checks when measuring the adjacent channel power.

Note that the numeric suffix <1...2> at LIMit is irrelevant when using these commands.

List of commands

- CALCulate:LIMit<1...2>:ACPower[:STATe] (p. 164)
- CALCulate:LIMit<1...2>:ACPower:ACHannel[:RELative] (p. 165)
- CALCulate:LIMit<1...2>:ACPower:ACHannel[:RELative]:STATe (p. 165)
- CALCulate:LIMit<1...2>:ACPower:ACHannel:ABSolute (p. 166)
- CALCulate:LIMit<1...2>:ACPower:ACHannel:ABSolute:STATe (p. 166)
- CALCulate:LIMit<1...2>:ACPower:ACHannel:RESult? (p. 166)
- CALCulate:LIMit<1...2>:ACPower:ALTernate<1…11>[:RELative] (p. 167)
- CALCulate:LIMit<1...2>:ACPower:ALTernate<1…11>[:RELative]:STATe (p. 167)
- CALCulate:LIMit<1...2>:ACPower:ALTernate<1…11>:ABSolute (p. 167)
- CALCulate:LIMit<1...2>:ACPower:ALTernate<1…11>:ABSolute:STATe (p. 168)
- CALCulate:LIMit<1...2>:ACPower:ALTernate<1…11>:RESult? (p. 168)

CALCulate:LIMit<1...2>:ACPower[:STATe]

This command activates and deactivates the limit check for ACP measurements. You have to use CALCulate:LIMit<1...2>:ACPower:ACHannel[:RELative]:STATe or CALCulate:LIMit<1...2>:ACPower:ALTernate<1...11>[:RELative]:STATe in combination with this command to specify whether the limit check should be performed for the upper / lower adjacent channel or for the alternate adjacent channels.

The numeric suffix <1...2> at LIMit is irrelevant.

Parameter

ON | OFF

Example

CALC:LIM:ACP ON
Activates the limit check

Characteristics

*RST value: OFF
SCPI: device-specific

CALCulate:LIMit<1...2>:ACPower:ACHannel[:RELative]

This command sets the relative limit of the upper / lower adjacent channel. The reference value for the relative limit value is the measured channel power.

Note that the relative limit has no effect on the limit check if it is below the absolute limit value (see CALCulate:LIMit<1...2>:ACPower:ACHannel:ABSolute). This mechanism allows automatic checking of the absolute basic values of adjacent-channel power as defined in mobile radio standards.

The numeric suffixe <1...2> at LIMit is irrelevant.

Parameter

<numeric value> = relative limit for the upper or lower adjacent channel between 0 and 100 dB

Example

CALC:LIM:ACP:ACH 30
Defines a limit of 30 dB.

Characteristics

*RST value:
SCPI: device-specific

CALCulate:LIMit<1...2>:ACPower:ACHannel[:RELative]:STATe

This command activates the relative limit check of the adjacent channel. The limit check must be activated with CALCulate:LIMit<1...2>:ACPower[:STATe] For the command to take effect. CALCulate:LIMit<1...2>:ACPower:ACHannel:RESult? queries the result.

Note that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no correct results are available.

The numeric suffixe <1...2> at LIMit is irrelevant.

Parameter

ON | OFF

Example

CALC:LIM:ACP:ACH:STAT ON
Activates the relative limit check.

Characteristics

*RST value: OFF
SCPI: device-specific

CALCulate:LIMit<1...2>:ACPower:ACHannel:ABSolute

This command defines the absolute limit for the lower / upper adjacent channel. It should be noted that the absolute limit has no effect on the limit check if it is below the relative limit (see CALCulate:LIMit<1...2>:ACPower:ACHannel[:RELative]). This mechanism allows automatic checking of the absolute basic values of adjacent-channel power as defined in mobile radio standards.

The numeric suffix <1...2> at LIMit is irrelevant.

Parameters

<numeric value> = absolute limit for the upper or lower adjacent channel. The range is from -200 dBm to + 200 dBm

Example

CALC:LIM:ACP:ACH:ABS –30
Sets the absolute limit to -30 dBm

Characteristics

*RST value: -
SCPI: device-specific

CALCulate:LIMit<1...2>:ACPower:ACHannel:ABSolute:STATe

This command activates the absolute limit check of the adjacent channel. The limit check must be activated with CALCulate:LIMit<1...2>:ACPower[:STATe] For this command to take effect. CALCulate:LIMit<1...2>:ACPower:ACHannel:RESult? queries the result.

Note that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no correct results are available.

The numeric suffixe <1...2> at LIMit is irrelevant.

Parameter

ON | OFF

Example

CALC:LIM:ACP:ACH:ABS:STAT ON
Activates the absolute limit check.

Characteristics

*RST value: OFF
SCPI: device-specific

CALCulate:LIMit<1...2>:ACPower:ACHannel:RESult?

This command queries the result of the limit check of the upper / lower adjacent channel. In case the ACP measurement is not active, the command returns a error.

This command is a query and therefore has no *RST value.

Return value

FAILED | PASSED

Example

CALC:LIM:ACP:ACH:RES?
Queries the limit check results.

Characteristics
*RST value: -
SCPI: device-specific

CALCulate:LIMit<1...2>:ACPower:ALTernate<1…11>[:RELative]

This command sets the relative limit of the alternate channels. The reference value for the relative limit value is the measured channel power.

Note that the relative limit has no effect on the limit check if it is below the absolute limit value (see CALCulate:LIMit<1...2>:ACPower:ALTernate<1…11>:ABSolute). This mechanism allows automatic checking of the absolute basic values of adjacent-channel power as defined in mobile radio standards.

The numeric suffix <1…11> at ALTernate selects the alternate channel number.

Parameter
<numeric value> = absolute limit for the alternate channels between 0 and 100 dB

Example
CALC:LIM:ACP:ALT3 30
Defines a limit of 30 dB for the third alternate channel.

Characteristics
*RST value: -
SCPI: device-specific

CALCulate:LIMit<1...2>:ACPower:ALTernate<1…11>[:RELative]:STATe

This command activates the relative limit check of the alternate channels. The limit check must be activated with CALCulate:LIMit<1...2>:ACPower[:STATe] for the command to take effect.. CALCulate:LIMit<1...2>:ACPower:ACHannel:RESult? queries the result.

Note that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no correct results are available.

The numeric suffix <1…11> at ALTernate selects the alternate channel number.

Parameter
ON | OFF

Example
CALC:LIM:ACP:ALT3:STAT ON
Activates the relative limit check for the third alternate channel.

Characteristics
*RST value: OFF
SCPI: device-specific

CALCulate:LIMit<1...2>:ACPower:ALTernate<1…11>:ABSolute

This command defines the absolute limit for the lower / upper adjacent channel. It should be noted that the absolute limit has no effect on the limit check if it is below the relative limit (see CALCulate:LIMit<1...2>:ACPower:ALTernate<1…11>[:RELative]). This mechanism allows automatic checking of the absolute basic values of adjacent-channel power as defined in mobile radio standards.

The numeric suffix <1…11> at ALTernate selects the alternate channel number.

Parameters

<numeric value> = absolute limit for the upper or lower adjacent channel. The range is from - 200 dBm to + 200 dBm

Example

`CALC:LIM:ACP:ALT3:ABS -30`
Sets the absolute limit to -30 dBm for the third alternate channel.

Characteristics

*RST value: -
SCPI: device-specific

CALCulate:LIMit<1...2>:ACPower:ALTernate<1…11>:ABSolute:STATe

This command activates the absolute limit check of the alternate channels. The limit check must be activated with `CALCulate:LIMit<1...2>:ACPower[:STATe]` for the command to take effect.. `CALCulate:LIMit<1...2>:ACPower:ACHannel:RESult?` queries the result.

Note that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no correct results are available.

The numeric suffix <1…11> at ALTernate selects the alternate channel number.

Parameter

ON | OFF

Example

`CALC:LIM:ACP:ALT3:ABS:STAT ON`
Activates the absolute limit check for the third alternate channel.

Characteristics

*RST value: OFF
SCPI: device-specific

CALCulate:LIMit<1...2>:ACPower:ALTernate<1…11>:RESult?

This command queries the result of the limit check of the upper / lower alternate channels. In case the ACP measurement is not active, the command returns an error.

The numeric suffix <1…11> at ALTernate selects the alternate channel number.

This command is a query and therefore has no *RST value.

Return value

FAILED | PASSED

Example

`CALC:LIM:ACP:ALT3:RES?`
Queries the limit check results for the third alternate channel.

Characteristics

*RST value: -
SCPI: device-specific

5.8.8.7   Measuring the Harmonic Distortion

The following commands configure Harmonic Distortion measurements. To perform the actual measurement, use the commands described in section "Performing and Triggering the Measurement".

List of commands

- CALCulate<1...2>:MARKer<1...6>:FUNCtion:HARMonics[:STATe] (p. 169)

- CALCulate<1...2>:MARKer<1...6>:FUNCtion:HARMonics:DISTortion? (p. 169)

- CALCulate<1...2>:MARKer<1...6>:FUNCtion:HARMonics:LIST? (p. 170)

- CALCulate<1...2>:MARKer<1...6>:FUNCtion:HARMonics:NHARmonics (p. 170)

- CALCulate<1...2>:MARKer<1...6>:FUNCtion:HARMonics:PRESet (p. 171)

CALCulate<1...2>:MARKer<1...6>:FUNCtion:HARMonics[:STATe]

This command activates and deactivates the harmonic distortion measurement.

The numeric suffixes at CALCulate and MARKer are irrelevant.

Parameter
ON | OFF

Example
CALC:MARK:FUNC:HARM ON
Activates the harmonic distortion measurement.

Characteristics
*RST value: OFF
SCPI: device-specific

CALCulate<1...2>:MARKer<1...6>:FUNCtion:HARMonics:DISTortion?

This command queries the total harmonic distortion of the signal. The command returns two values, one for the total harmonic distortion in % and one in dB.

To get a valid result, you should perform a complete sweep in single sweep mode before querying the results.

The numeric suffixes at CALCulate and MARKer are irrelevant.

This command is a query and therefore has no *RST value.

Parameter
TOTal

Example
CALC:MARK:FUNC:HARM ON
Activates the harmonic distortion measurement.

CALC:MARK:FUNC:HARM:DIST? TOT
Queries the total harmonic distortion.

Characteristics
*RST value: -
SCPI: device-specific

CALCulate<1...2>:MARKer<1...6>:FUNCtion:HARMonics:LIST?

This command queries the position of the harmonics. The number of values that the command returns depends on the number of harmonics you have set with the CALCulate<1...2>:MARKer<1...6>:FUNCtion:HARMonics:NHARmonics command. The first value is the absolute power of the first harmonic. The level unit depends on the unit you have set with the UNIT:POWer command. The other values are relative to the carrier. The unit for these is dB.

To get a valid result, you should perform a complete sweep in single sweep mode before querying the results.

The numeric suffixes at CALCulate and MARKer are irrelevant.

This command is a query and therefore has no *RST value.

Example

`CALC:MARK:FUNC:HARM ON`
Activates the harmonic distortion measurement.

`CALC:MARK:FUNC:HARM:LIST?`
Queries the position of the harmonics.

Characteristics

*RST value: -
SCPI: device-specific

CALCulate<1...2>:MARKer<1...6>:FUNCtion:HARMonics:NHARmonics

Sets the number of harmonics you want to measure. The valid range is from 1 to 6 harmonics.

The numeric suffixes at CALCulate and MARKer are irrelevant.

Parameter

1 to 6

Example

`CALC:MARK:FUNC:HARM ON`
Activates the harmonic distortion measurement.

`CALC:MARK:FUNC:HARM:NHAR 4`
Sets the number of harmonics to 4.

Characteristics

*RST value: 2
SCPI: device-specific

CALCulate<1...2>:MARKer<1...6>:FUNCtion:HARMonics:PRESet

This command adjusts and optimizes the settings for the Harmonic Distortion measurement.

This command is an event and therefore has no query and no *RST value.

Example

`CALC:MARK:FUNC:HARM ON`
Activates the harmonic distortion measurement.

`CALC:MARK:FUNC:HARM:PRES?`
Adjusts the settings of the measurement.

Characteristics
*RST value: -
SCPI: device-specific

5.8.8.8   Measuring the AM Modulation Depth

The following commands configure AM Modulation Depth measurements. To perform the actual measurement, use the commands described in section "Performing and Triggering the Measurement".

List of commands

- CALCulate<1...2>:MARKer<1...6>:FUNCtion:MDEPth[:STATe] (p. 171)

- CALCulate<1...2>:MARKer<1...6>:FUNCtion:MDEPth:RESult? (p. 171)

CALCulate<1...2>:MARKer<1...6>:FUNCtion:MDEPth[:STATe]

This command activates and deactivates the AM Modulation Depth measurement.

The numeric suffixes at CALCulate and MARKer are irrelevant.

Parameter
ON | OFF

Example

`CALC:MARK:FUNC:MDEP ON`
Activates the harmonic distortion measurement.

Characteristics
*RST value: OFF
SCPI: device-specific

CALCulate<1...2>:MARKer<1...6>:FUNCtion:MDEPth:RESult?

This command queries the results of the AM Modulation Depth measurement in %.

This command is a query and therefore has no *RST value.

Parameter
ON | OFF

Example

`CALC:MARK:FUNC:MDEP:RES?`
Queries the AM Modulation Depth.

Characteristics
*RST value: -
SCPI: device-specific

5.8.8.9   Measuring the Spectrum Emission Mask

The following commands configure Spectrum Emission Mask (SEM) measurements. To perform the actual measurement, use the commands described in section "Performing and Triggering the Measurement".

List of commands

- [SENSe:]ESPectrum:PRESet[:STANdard] (p. 172)

- [SENSe:]ESPectrum:PRESet:SETTings (p. 172)

- [SENSe:]SWEep:MODE (p. 173)

[SENSe:]ESPectrum:PRESet[:STANdard]

This command sets the SEM standard.

Parameter
<string> = file name of the standard you want to load

Example
```
ESP:PRES 'W-CDMA 3GPP.semstd'
```
Queries the AM Modulation Depth.

Characteristics
*RST value: -
SCPI: device-specific

[SENSe:]ESPectrum:PRESet:SETTings

This command performs an automatic adjustment of the R&S FSC settings.

Parameter
ONCE

Example
```
ESP:PRES:SET ONCE
```
Initializes an adjustment of the settings.

Characteristics
*RST value: -
SCPI: device-specific

[SENSe:]SWEep:MODE

This command activates the SEM measurement.

Parameter

AUTO   Activates spectrum measurement mode.

ESPectrum   Activates SEM measurement mode.

Example

SWE:MODE ESP
Starts the SEM measurement.

Characteristics

*RST value: AUTO
SCPI: device-specific

5.9   Remote Commands in Network Analyzer Mode

The chapter provides information on remote commands that configure and perform two-port measurements with the tracking generator. These commands are available in Network Analyzer mode only.

Availability of remote commands for the Network Analyzer

Note that some of the listed remote commands take effect only if options R&S FSC-K42 Vector Reflection and Transmission Measurements and / or R&S FSC-K45 Vector Voltmeter are installed.

5.9.1   Setting the Frequency and Span

The following commands configure the frequency axis (x-axis) of the active display.

List of commands

- [SENSe:]FREQuency:CENTer (p. 113)

- [SENSe:]FREQuency:CENTer:STEP (p. 113)

- [SENSe:]FREQuency:CENTer:STEP:LINK (p. 113)

- [SENSe:]FREQuency:INPut:MODE on page 114

- [SENSe:]FREQuency:SPAN (p. 115)

- [SENSe:]FREQuency:SPAN:FULL (p. 115)

- [SENSe:]FREQuency:STARt (p. 115)

- [SENSe:]FREQuency:STOP (p. 116)

For a detailed description of the commands refer to "Setting the Frequency and the Span" in Spectrum Analyzer Mode.

5.9.2   Setting Amplitude Parameters

The following commands configure the level axis (y-axis) and level parameters of the active display.

In Network Analyzer mode, the numeric suffix <1...2> at DISPlay selects the measurement screen in dual trace mode.

List of commands

- DISPlay<1...2>:MAGNitude:REFerence (p. 175)

- DISPlay<1...2>:MAGNitude:REFerence:POSition (p. 175)

- DISPlay<1...2>:MAGNitude:Y:SCALe (p. 175)

- DISPlay<1...2>:MAGNitude:Y:SPACing (p. 176)

- SOURce:TG:ATTenuation (p. 176)

- UNIT:POWer (p. 121)

For a detailed description of commands not described below refer to "Setting Amplitude Parameters" in Spectrum Analyzer Mode.

DISPlay<1...2>:MAGNitude:REFerence

This command sets the reference level for the magnitude measurement format.

Parameter

<numeric_value>

Example

DISP:MAGN:REF -10
Sets the reference level to -10 dB

Characteristics

*RST value: 0 dB
SCPI: device-specific

DISPlay<1...2>:MAGNitude:REFerence:POSition

This command defines the position of the reference value on the display for the magnitude measurement format. Each step shifts the reference position one grid line up or down.

Parameter

1 to 10

Example

DISP:MAGN:REF:POS 5
Sets the reference to the center of the display (i.e. the fifth grid line from the bottom).

Characteristics

*RST value: 10
SCPI: device-specific

DISPlay<1...2>:MAGNitude:Y:SCALe

This command defines the display range of the y-axis with logarithmic scaling for the Magnitude measurement format.

Use the DISPlay[:WINDow]:TRACe<1...2>:Y:SPACing command to switch to logarithmic scaling.

Parameter

<numeric value>

Example

DISP:MAGN:Y:SCAL 50 DB
Sets the display range of the y-axis to 50 dB

Characteristics

*RST value: 100 dB
SCPI: device-specific

DISPlay<1...2>:MAGNitude:Y:SPACing

This command sets the scaling of the y-axis for the Magnitude measurement format to either linear or logarithmic.

Parameter

LINear | LOGarithmic

Example

DISP:MAGN:Y:SPAC LIN
Switches the y-axis to linear scaling

Characteristics

*RST value: LOGarithmic
SCPI: device-specific

SOURce:TG:ATTenuation

This command sets the output level of the tracking generator.

You can set the output level by selecting an attenuation value. The range is from 0 dB to 50 dB. Setting the attenuation to 0 dB results in an output level of 0 dBm. If you set the attenuation to 50 dB, the resulting output level is -50 dBm.

Parameter

0 to 50

Example

SOUR:TG:ATT 50
Sets the attenuation to 50 dB and therefore an output level of –50 dBm

Characteristics

*RST value: 0 dB
SCPI: device-specific

5.9.3   Setting the Bandwidth

The following commands configure the filter bandwidths of the R&S FSC. Note that both groups of commands (BANDwidth and BWIDth) are the same.

List of commands

- [SENSe:]BANDwidth|BWIDth[:RESolution] (p. 122)

- [SENSe:]BANDwidth|BWIDth[:RESolution]:AUTO (p. 122)

For a detailed description of commands refer to "Setting the Bandwidths" in Spectrum Analyzer Mode.

5.9.4   Performing and Triggering the Measurement

The following commands configure the sweep.

List of commands

- *WAI (p. 111)

- ABORt (p. 124)

- INITiate[:IMMediate] (p. 124)

- INITiate:CONTinuous (p. 125)

- [SENSe:]SWEep:COUNt (p. 125)

- [SENSe:]SWEep:POINts? (p. 126)

- [SENSe:]SWEep:TIME (p. 126)

- [SENSe:]SWEep:TIME:AUTO (p. 126)

- TRIGger[:SEQuence]:HOLDoff[:TIME] (p. 128)

- TRIGger[:SEQuence]:SLOPe (p. 129)

- TRIGger[:SEQuence]:SOURce (p. 129)

For a detailed description of commands refer to "Performing and Triggering the Measurement" in Spectrum Analyzer Mode.

5.9.5   Working with Traces

The following commands set up the trace and the various functions associated with it, e.g. the selection of the detector.

List of commands

- DISPlay[:WINDow]:TRACe<1...2>[:STATe] (p. 131)

- DISPlay[:WINDow]:TRACe<1...2>:MEMory[:STATe] (p. 131)

- DISPlay[:WINDow]:TRACe<1...2>:MODE (p. 132)

- FORMat[:DATA] (p. 134)

- FORMat:BORDer (p. 132)

- [SENSe:]DETector[:FUNCtion] (p. 133)

- [SENSe:]DETector<1...6>[:FUNCtion]:AUTO (p. 133)

- TRACE<1...2>[:DATA]? (p. 178)

For a detailed description of commands refer to "Working with Traces" in Spectrum Analyzer Mode.

TRACE<1...2>[:DATA]?

This command transfers trace data from the control computer to the instrument, the query reads trace data out of the instrument. The transfer of trace data from the control computer to the instrument takes place by indicating the trace name and then the data to be transferred.

With the FORMat[:DATA] command, you can set the format the trace data is returned in.

Parameter

TRACE1

Return values for trace data in Network Analyzer mode

631 results are returned, one result for each point of the trace. The return values are scaled in the currently selected unit.

Example

```
TRAC:DATA? TRACE1
```
Reads out the data for trace 1

Characteristics

*RST value: -
SCPI: conform

5.9.6   Using Markers and Deltamarkers

5.9.6.1   Markers and Deltamarkers

The following commands are for setting and controlling markers and deltamarkers. If not otherwise noted, the numeric suffix <1...6> at MARKer or DELTamarker select the marker to be controlled.

In Network Analyzer mode, the numeric suffix <1...2> at CALCulate selects the measurement screen in dual trace mode.

List of commands

- CALCulate<1...2>:DELTamarker<1...6>[:STATe] (p. 136)

- CALCulate<1...2>:DELTamarker<1...6>:AOFF (p. 136)

- CALCulate<1...2>:DELTamarker<1...6>:MAXimum[:PEAK] (p. 136)

- CALCulate<1...2>:DELTamarker<1...6>:MAXimum:NEXT (p. 136)

- CALCulate<1...2>:DELTamarker<1...6>:MINimum[:PEAK] (p. 137)

- CALCulate<1...2>:DELTamarker<1...6>:X (p. 137)

- CALCulate<1...2>:DELTamarker<1...6>:X:RELative (p. 137)

- CALCulate<1...2>:DELTamarker<1...6>:Y? (p. 138)

- CALCulate<1...2>:MARKer<1...6>[:STATe] (p. 138)

- CALCulate<1...2>:MARKer<1...6>:AOFF (p. 139)

- CALCulate<1...2>:MARKer<1...6>:MAXimum[:PEAK] (p. 139)

- CALCulate<1...2>:MARKer<1...6>:MAXimum:NEXT (p. 139)

- CALCulate<1...2>:MARKer<1...6>:MINimum[:PEAK] (p. 139)

- CALCulate<1...2>:MARKer<1...6>:X (p. 140)

- CALCulate<1...2>:MARKer<1...6>:X:SLIMits[:STATe] (p. 140)

- CALCulate<1...2>:MARKer<1...6>:X:SLIMits:LEFT (p. 140)

- CALCulate<1...2>:MARKer<1...6>:X:SLIMits:RIGHt (p. 141)

- CALCulate<1...2>:MARKer<1...6>:Y? (p. 179)

For a detailed description of commands not described below refer to "Using Markers" in Spectrum Analyzer Mode.

CALCulate<1...2>:MARKer<1...6>:Y?

This command queries the measured value of the selected marker. The corresponding marker is activated before or switched to marker mode, if necessary.

To obtain a correct query result, a complete sweep with synchronization to the sweep end must be performed between the activation of the marker and the query of the Y value. This is only possible in single sweep mode.

Return values

NORMal   <value> = trace value

Example

`INIT:CONT OFF`
Switches to single sweep mode.

`CALC:MARK2 ON`
Switches marker 2.

`INIT;*WAI`
Starts a sweep and waits for the end.

`CALC:MARK2:Y?`
Outputs the measured value of marker 2.

Characteristics

*RST value: –
SCPI: device–specific

5.9.7   Configuring the Measurement

This chapter provides information on how to configure two-port measurements with the tracking generator. The structure follows the order of the actual operation sequence used when performing a measurement:

- Calibrating the Measurement on page 180

To perform the actual measurement, use the commands described in section "Performing and Triggering the Measurement".

> **Commands independent of the operating mode**
>
> Note that some of the commands for configuring two-port measurements are also valid for other operating modes. If a command is available in another mode, it is indicated by the list in the respective section.

5.9.7.1 Calibrating the Measurement

The following commands query and control calibration for two-port measurements.

List of commands:

CALibration:MODE?

This command queries if the current measurement mode is calibrated.

This command is a query and therefore has no *RST value.

Return values

0   not calibrated

1   calibrated

Example

CAL:MODE?

Characteristics

*RST value: -
SCPI: device-specific

CALibration:STATus?

This command queries whether the R&S FSC is fully calibrated for the current measurement mode or not.

This command is a query and therefore has no *RST value.

Return values

NORM   the R&S FSC is fully calibrated

APPR   the R&S FSC is approximately calibrated, meaning that greater measurement uncertainty must be anticipated

Example

CAL:STAT?
Queries the calibration status of the R&S FSC.

Characteristics

*RST value: -
SCPI: device-specific

5.10   Remote Commands in Power Meter Mode

The chapter provides information on remote commands that configure and perform power measurements with the power sensor. These commands are available in Network Analyzer mode only.

Availability of remote commands for Power Sensor measurements

Note that the listed remote commands take effect only if a power sensor is connected.

5.10.1   Setting the Frequency

The following chapter describes commands necessary to define frequency settings.

List of commands

- [SENSe:]PMETer:FREQuency (p. 181)

[SENSe:]PMETer:FREQuency

This command sets the frequency of the power sensor.

Parameter
<numeric value> = frequency in Hz

Example
```
PMET:FREQ 500 MHZ
```
Sets the power sensor's frequency to 500 MHz

Characteristics
*RST value: -
SCPI: device-specific

5.10.2 Configuring Power Level Readout

The following chapter describes commands that configure the power level readout.

List of commands

CALCulate:PMETer:RELative[:MAGNitude]

This command sets the reference level for relative measurements.

Parameter

<numeric value> = level of the reference value

Example

CALC:PMET:REL 30
The the reference value to 30 dBm.

Characteristics

*RST value: -
SCPI: device-specific

CALCulate:PMETer:RELative[:MAGNitude]:AUTO

This command sets the current measurement result as the reference level for relative measurements.

This command is an event and therefore has no *RST value and no query.

Parameter

ONCE

Example

CALC:PMET:REL ONCE

Characteristics

*RST value: -
SCPI: device-specific

CALCulate:PMETer:RELative[:MAGNitude]:OFFSet

This command sets the offset of the reference level for relative measurements.

Parameter

<numeric value> = reference offset

Example

CALC:PMET:REL -10

Characteristics

*RST value: -
SCPI: device-specific

UNIT<1...2>:PMETer:POWer

This command selects the unit of the power sensor.

The suffix at UNIT has the following effects:

Unit 1   Power unit

Unit 2   not available.

Parameter

DBM | WATT | W | DB | VSWR

Note on the parameter DB: when applied to UNIT1, the power is relative to the reference level, when applied to UNIT2, the return loss is displayed.

Note on the parameter VSWR: the parameter is only available if applied to UNIT2.

Example

```
UNIT1:PMET:POW DBM
```
When measuring with the R&S FSC-Z1 or R&S FSC-Z18: sets unit to dBm.

When measuring with the R&S FSC-Z14 or R&S FSC-Z44: sets unit of forward power to dBm.

Characteristics

*RST value: -
SCPI: device-specific

5.10.3   Defining the Measurement Time

The following chapter describes commands to define the measurement time of the power sensor.

[SENSe:]PMETer:MTIMe

This command sets the duration of measurements with the power sensor.

Parameter

SHORt | NORMal | LONG

Example

```
PMET:MTIMe SHOR
```
Sets a short measurement time for power measurements.

Characteristics

*RST value: -
SCPI: device-specific

5.10.4 Performing Measurements with the Power Sensor

The following chapter describes all commands that are available for performing power measurements with the power sensor.

- CALibration:PMETer:ZERO:AUTO (p. 184)

- FETch<1...2>:PMETer? (p. 184)

5.10.4.1 Zeroing of the Power Sensor

CALibration:PMETer:ZERO:AUTO

This commands starts to zero the power sensor.

Parameter
ONCE

Example
CAL:PMET:ZERO:AUTO ONCE
Starts to zero the power meter.

Characteristics
*RST value: -
SCPI: device-specific

5.10.4.2 Reading Out Measurement Results

FETch<1...2>:PMETer?

This command queries the results of measurements with the power sensor.

Return values
FETch1   returns the power unit

FETch2   not available

Example
FET1:PMET?
Returns the power unit.

Characteristics
*RST value: -
SCPI: device-specific

5.11 Saving and Restoring Instrument Settings and Measurement Results

The following commands perform various tasks in the context of file management.

These commands are independent from the operating mode.

List of commands

- MMEMory:CATalog? (p. 185)
- MMEMory:CATalog:DIRectories? (p. 186)
- MMEMory:CDIRectory (p. 186)
- MMEMory:COPY (p. 186)
- MMEMory:DATA (p. 187)
- MMEMory:DELete (p. 187)
- MMEMory:FILE (p. 188)
- MMEMory:FILE:DATE (p. 188)
- MMEMory:FILE:TIME (p. 188)
- MMEMory:INIT (p. 188)
- MMEMory:LOAD:STATe (p. 189)
- MMEMory:MDIRectory (p. 189)
- MMEMory:MOVE (p. 189)
- MMEMory:RDIRectory (p. 190)
- MMEMory:STORe:STATe (p. 190)

MMEMory:CATalog?

This command reads the indicated directory. According to DOS convention, wild card characters can be entered in order to query e.g. a list of all files of a certain type.

This command is a query and therefore has no *RST value.

Parameter

<path> = DOS Path name

The path name should be in conformance with DOS conventions and may also include the drive name.

Return values

List of file names in the form of strings separated by commas, i.e.
SPOOL1.WMF,SPOOL2.WMF,SPOOL3.WMF

Example

```
MMEM:CAT? 'D:\USER\*.DFL'
```
Returns all files in D:\user with extension ".DFL"

```
MMEM:CAT? 'D:\USER\SPOOL?.WMF'
```
Returns all files in D:\USER whose names start with SPOOL, have 6 letters and the extension ".WMF".

Characteristics

*RST value: -
SCPI: conform

MMEMory:CATalog:DIRectories?

This command lists the size of memory used by files and the size of memory space available togehter with a list of subdirectories.

This command is a query and therefore has no *RST value.

Example

`MMEM:CAT:DIR?`
Returns memory allocation and subdirectory information.

Characteristics

*RST value: -
SCPI: device-specific

MMEMory:CDIRectory

This command changes the current directory.

Parameter

<directory_name> = DOS path name

In addition to the path name, the indication of the directory may contain the drive name. The path name complies with the DOS conventions.

Example

`MMEM:CDIR 'D:\user'`
Selects the directory D:\USER.

Characteristics

*RST value: -
SCPI: conform

MMEMory:COPY

This command copies the files indicated in <file_source> to the destination directory indicated with <file_destination> or to the destination file indicated by <file_destination> if <file_source> is just a file.

This command is an event and therefore has no *RST value and no query.

Parameter

<file_source>,<file_destination> = <file_name> = DOS file name

The indication of the file name may include the path and the drive name. The file names and path information must be in accordance with the DOS conventions.

Example

`MMEM:COPY 'D:\USER\SETUP.CFG','E:'`
Copies the SETUP.CFG file to drive E:

Characteristics

*RST value: -
SCPI: conform

MMEMory:DATA

This command writes the block data contained in <block> into the file characterized by <file_name>. The delimiter must be set to EOI to obtain error-free data transfer. The associated query command reads the indicated file from the mass memory and transfers it to the remote control computer. It should be noted that the buffer memory of the control computer should be large enough to store the file. The setting of the delimiter is irrelevant in this case.

The command is useful for reading stored settings files or trace data from the instrument or for transferring them to the instrument.

Parameter
<file_name>[,<block>]

<file_name>   selects the file to be transferred

<block>   binary data block with the following structure:

- character '#'

- digit for the length of the length information

- indicated number of digits as length information (number of bytes) for the binary data themselves

- binary data with the indicated number of bytes

Example
MMEM:DATA 'TEST01.HCP,#216This is the file'
means: #2: the next 2 characters are the length indication; 16: number of subsequent binary data bytes; This is the file: 16 bytes stored as binary data in the file TEST01.HCP.

MMEM:DATA? 'TEST01.HCP'
Transfers the file TEST01.HCP from the instrument to the control computer.

Characteristics
*RST value: -
SCPI: conform

MMEMory:DELete

This command deletes the indicated files.

Parameter
<file_name> = DOS file name

The indication of the file name contains the path and, optionally, the drive name. Indication of the path complies with DOS conventions.

Example
MMEM:DEL 'TEST01.HCP'
The file TEST01.HCP is deleted.

Characteristics
*RST value: -
SCPI: conform

MMEMory:FILE

This command creates a file with the specified name.

Parameter
<string> = file name

Example
MMEM:FILE 'TEST.TXT'
Creates the file TEST.TXT

Characteristics
*RST value: -
SCPI: conform

MMEMory:FILE:DATE

This command sets or reads the date of the indicated file. The sequence of entry is year, month, day.

Parameter
1980...2099, 1...12, 1...31

Example
MMEM:FILE:DATE 2010,04,01
Sets the date to April, 1st, 2010.

Characteristics
*RST value: -
SCPI: conform

MMEMory:FILE:TIME

This command sets the time of the indicated file. The sequence of entry is hour, minute, second.

Parameter
0...23, 0...59, 0...59

Example
MMEM:FILE:TIME 12,00,00
Sets the time to 12:00:00

Characteristics
*RST value: -
SCPI: conform

MMEMory:INIT

This command formats the indicated drive.

Note: Formatting deletes all data stored on the memory drive.

This command is an event and therefore has no *RST value and no query.

Example:
MMEM:INIT
Formats and deletes all data from the drive.

Characteristics:
*RST value: -
SCPI: conform

MMEMory:LOAD:STATe

This command loads the device settings from *.set files. The contents of the file are loaded and set as the new device state.

Parameter

1,<file_name>

with <file_name> = DOS file name without extension

The file name includes indication of the path and may also include the drive name. The path name complies with DOS conventions.

Example

`MMEM:LOAD:STAT 1,'D:\USER\TEST01.SET'`
Loads the settings from the file TEST01.

Characteristics

*RST value: -
SCPI: conform

MMEMory:MDIRectory

This command creates a new directory. The file name includes indication of the path and may also include the drive name. The path name complies with DOS conventions.

This command is an event and therefore has no *RST value and no query.

Parameter

<directory_name> = DOS path name

Example

`MMEM:MDIR 'D:\USER'`
Creates the USER directory on drive D:

Characteristics

*RST value: -
SCPI: device-specific

MMEMory:MOVE

This command renames existing files, if <file_destination> contains no path. Otherwise the file is moved to the indicated path and stored under the file name specified there.

This command is an event and therefore has no *RST value and no query.

Parameter

<file_source>,<file_destination> = <file_name> = DOS file name

The file name includes indication of the path and may also include the drive. The path name complies with DOS conventions.

Example

`MMEM:MOVE 'C:\TEST01.CFG','SETUP.CFG'`
Renames TEST01.CFG in SETUP.CFG in directory C:\.

```
MMEM:MOVE 'C:\TEST01.CFG','C:\USER
```
Moves TEST01.CFG from C:\ to C:\USER.

```
MMEM:MOVE 'C:\TEST01.CFG','C:\USER\SETUP.CFG'
```
Moves TEST01.CFG from C:\ to C:\R_S\Instr\user and renames the file in SETUP.CFG.

Characteristics

*RST value: -
SCPI: conform

MMEMory:RDIRectory

This command deletes the indicated directory. The directory name includes the path and may also include the drive name. The path name complies with DOS conventions.

This command is an event and therefore has no *RST value and no query.

Parameter

<directory_name> = DOS path name

Example

```
MMEM:RDIR 'C:\TEST'
```
Deletes the directory 'TEST' on drive C:

Characteristics

*RST value: -
SCPI: device-specific

MMEMory:STORe:STATe

This command stores the current device settings in a *set file.

This command is an event and therefore has no *RST value and no query.

Parameter

1,<file_name>

with <file_name> = DOS file name without extension

The file name includes the path and may also include the drive name. The path name complies with DOS conventions.

Example

```
MMEM:STOR:STAT 1,'DATASET001.SET'
```
Saves the current device settings in the file DATASET001.SET.

Characteristics

*RST value: -
SCPI: conform

5.12   Making and Storing Screenshots

The following commands manage screenshots.

These commands are independent from the operating mode.

List of commands

- HCOPy[:IMMediate] (p. 191)

- MMEMory:NAME (p. 191)

HCOPy[:IMMediate]

This command makes a screenshot of the current trace and stores it on the R&S FSC internal hard disk.

This command is an event and therefore has no *RST value and no query.

Example

```
MMEM:NAME '\Public\Screenshots\Test.png'
```
Defines the file name of the screenshot.

```
HCOP
```
Makes and stores a screenshot of the current screen.

Characteristics

*RST value: -
SCPI: device-specific

MMEMory:NAME

This command defines the path and file name that the R&S FSH uses for storing screenshots (see HCOPy[:IMMediate] command). The path and file name comply with DOS conventions.

This command is an event and therefore has no *RST value and no query.

Parameter

<file_name> = DOS file name (incl. path name)

Example

```
MMEM:NAME 'Public\Screenshots\Test.png'
```
Stores the screenshot under D:\Test

Characteristics

*RST value: -
SCPI: device-specific

5.13 Configuring the Instrument

The following commands configure general instrument settings.

These commands are independent from the operating mode.

5.13.1 Mode Selection

This chapter describes all commands that select the operating mode of the R&S FSC.

List of commands

INSTrument[:SELect]

This command switches between the measurement modes by means of text parameters.

Parameter

SANalyzer   Spectrum Analyzer

NAN   Network Analyzer

PM   Power Meter

Example

`INST SAN`
Switches the instrument to spectrum analyzer mode.

Characteristics

*RST value: SANalyzer
SCPI: conform

INSTrument:NSELect

This command switches between the measurement modes by means of numbers.

Parameter

1   Spectrum Analyzer

2   Network Analyzer

5   Power Meter

Example

`INST:NSEL 1`
Switches the instrument to spectrum analyzer mode.

Characteristics

*RST value: 1
SCPI: conform

5.13.2   Display Configuration

This chapter describes commands to set up the display of the R&S FSC via remote control.

List of Commands

- DISPlay:CMAP (p. 193)
- DISPlay:CMAP:DEFault (p. 193)
- DISPlay:DATE:FORMat (p. 193)

DISPlay:CMAP

This command sets the color scheme of the display to either color or black and white.

Parameter
COLor | BW

Example
DISP:CMAP BW
Sets the screen colors to black and white

Characteristics
*RST value: COLor
SCPI: conform

DISPlay:CMAP:DEFault

This command resets the screen colors of all display items to their default settings, i.e. to the color scheme.

This command is an event and therefore has no query and no *RST value.

Example
DISP:CMPA:DEF
Restores the default screen colors

Characteristics
*RST value: -
SCPI: conform

DISPlay:DATE:FORMat

This command sets the display date format.

Parameter
DDMMyyyy | MMDDyyyy

Example
DISP:DATE:FORM DDMMyyyy
Characteristics
*RST value: DDMMyyyy
SCPI: device-specific

5.13.3   Audio Settings

This chapter describes all commands to control the audio functions of the R&S FSC.

List of commands

SYSTem:AUDio:VOLume

This command sets the volume of the internal speaker. The range is between 0 and 1, with 1 being the maximum possible volume.

Parameter

0 to 1

Example

SYST:AUD:VOL 0.40
Sets the volume to 40%

Characteristics

*RST value: 0.3 (30%)
SCPI: device-specific

SYSTem:BEEPer:VOLume

This command sets the volume of the beeper, activated with
CALCulate<1...2>:LIMit<1...2>:BEEP[:STATe]. The range is between 0 and 1, with 1 being the maximum possible volume.

Parameter

0 to 1

Example

SYST:BEEP:VOL 0.50
Sets the volume of the beeper to 50%

Characteristics

*RST value: 0.6 (60%)
SCPI: conform

SYSTem:BEEPer:KEY:VOLume

This command sets the volume of the keyboard clicking. The range is between 0 and 1, with 1 being the maximum possible volume.

Parameter

0 to 1

Example

SYST:BEEP:KEY:VOL 0.10
Sets of keyboard clicking volume to 10%

Characteristics

*RST value: 0.3 (30%)
SCPI: conform

5.13.4   Setting up a Network Connection

This chapter describes all commands that are used if the R&S FSC is part of a network.

List of commands

- SYSTem:COMMunicate:LAN:ETHernet? (p. 195)
- SYSTem:COMMunicate:LAN:SUBMask (p. 196)
- SYSTem:COMMunicate:SOCKet:ADDRess (p. 196)
- SYSTem:COMMunicate:SOCKet:DHCP[:STATe] (p. 196)
- SYSTem:COMMunicate:SOCKet:PORT (p. 197)

SYSTem:COMMunicate:LAN:ETHernet?

This command queries the MAC address of the R&S FSC.

This command is a query and therefore has no *RST value.

Example

SYST:COMM:LAN:ETH?
Returns the MAC address

Characteristics

*RST value: -
SCPI: device-specific

SYSTem:COMMunicate:LAN:SUBMask

This command sets the subnet mask address of the R&S FSC.

Parameter
<string> = subnet mask address

Example
SYST:COMM:LAN:SUBM '255.255.255.0'
Sets the subnet mask address to 255.255.255.0

Characteristics
*RST value: 255.255.255.0
SCPI: device-specific

SYSTem:COMMunicate:SOCKet:ADDRess

This command sets the IP address of the R&S FSC.

Parameter
<string> = IP address

Example
SYST:COMM:SOCK:ADDR '172.76.68.30'
Sets the IP address of the R&S FSC to 172.76.68.30

Characteristics
*RST value: 172.76.68.24
SCPI: device-specific

SYSTem:COMMunicate:SOCKet:DHCP[:STATe]

This command activates and deactivates the Dynamic Host Configuration Protocol (DHCP).

Parameter
ON | OFF

Example
SYST:COMM:SOCK:DHCP ON
Activates DHCP.

Characteristics
*RST value: ON
SCPI: device-specific

SYSTem:COMMunicate:SOCKet:PORT

This command sets the port number for the connection.

Parameter

<port_number>

Example

SYST:COMM:SOCK:PORT 1000
Sets the port number to 1000

Characteristics

*RST value: 5555
SCPI: device-specific

5.13.5 System Settings

This chapter describes all commands that define or query general system settings.

List of commands

- INPut:IMPedance:PAD (p. 198)
- [SENSe:]ROSCilator:SOURce (p. 198)
- SYSTem:BNC<1...2>:MODE (p. 198)
- SYSTem:DATE (p. 198)
- SYSTem:ERRor[:NEXT]? (p. 199)
- SYSTem:ERRor:ALL? (p. 199)
- SYSTem:ERRor:COUNt? (p. 200)
- SYSTem:ERRor:CODE[:NEXT]? (p. 199)
- SYSTem:ERRor:CODE:ALL? (p. 200)
- SYSTem:HELP:HEADers? (p. 200)
- SYSTem:HELP:SYNTax? (p. 200)
- SYSTem:LANGuage:CATalog? (p. 201)
- SYSTem:POWer:SOURce? (p. 201)
- SYSTem:POWer:STATus? (p. 201)
- SYSTem:PRESet:FACTory (p. 202)
- SYSTem:TIME (p. 202)
- SYSTem:VERSion? (p. 202)

INPut:IMPedance:PAD

This command selects the matching pad connected to the R&S FSC.

Parameter

RAM | RAZ | HZTE

Example

INPut:IMP 75;PAD RAZ
Selects 75 U input impedance and the R&S RAZ as the currently used matching pad.

Characteristics

*RST value: -
SCPI: device-specific

[SENSe:]ROSCilator:SOURce

This command selects the source of the frequency reference oscillator.

If you use an external reference signal, make sure to connect the signal to the Ext Ref BNC connector of the R&S FSC.

Parameter

INTernal | EXTernal

Example

ROSC:SOUR EXT
Activates external source as reference signal.

Characteristics

*RST value: -
SCPI: device-specific

SYSTem:BNC<1...2>:MODE

This command selects the function the BNC socket indicated by the numeric suffix is used for.

Parameter

REFerence | TRIGger | IF3 | IFDac

Example

SYST:BNC2:MODE TRIG
Sets the seconds BNC socket to function as a trigger.

Characteristics

*RST value: BNC 1: TRIGger, BNC 2: IF3
SCPI: device-specific

SYSTem:DATE

This command sets the date for the internal calendar.

The sequence of entry is year, month, day.

Parameter

1980 to 2099, 1 to 12, 1 to 31

Example

SYST:DATE 2000,6,1

Characteristics

*RST value: -

SCPI: conform

SYSTem:ERRor[:NEXT]?

This command queries the earliest error queue entry and deletes it. The entry consists of an error number and a short description of the error.

Positive error numbers indicate device-specific errors, negative error numbers are error messages defined by SCPI. If the error queue is empty, the error number 0, "No error", is returned.

This command is a query and therefore has no *RST value.

Example

STAT:ERR?

Characteristics

*RST value: -
SCPI: conform

SYSTem:ERRor:ALL?

This command retrieves all entries in the error queue. The entry consists of an error number and a short description of the error.

Positive error numbers indicate device-specific errors, negative error numbers are error messages defined by SCPI. If the error queue is empty, the error number 0 is returned.

This command is a query and therefore no *RST value.

Example

SYST:ERR:ALL?

Characteristics

*RST value: -

SCPI: device-specific

SYSTem:ERRor:CODE[:NEXT]?

This command queries the earliest error queue entry and deletes it. The entry consists of the error number only..

Positive error numbers indicate device-specific errors, negative error numbers are error messages defined by SCPI. If the error queue is empty, the error number 0, "No error", is returned.

This command is a query and therefore has no *RST value.

Example

STAT:ERR:CODE?

Characteristics

*RST value: -

SCPI: conform

SYSTem:ERRor:CODE:ALL?

This command retrieves all entries in the error queue. The entry consists of the error number only..

Positive error numbers indicate device-specific errors, negative error numbers are error messages defined by SCPI. If the error queue is empty, the error number 0 is returned.

This command is a query and therefore no *RST value.

Example

```
SYST:ERR:CODE:ALL?
```

Characteristics

*RST value: -
SCPI: device-specific

SYSTem:ERRor:COUNt?

This command queries the number of errors currently in the error queue.

This command is a query and therefore no *RST value.

Example

```
SYST:ERR:COUN?
```

Characteristics

*RST value: -

SCPI: device-specific

SYSTem:HELP:HEADers?

This command returns a list of all common commands and instrument-control commands and queries implemented in the instrument.

This command is a query and therefore no *RST value.

Example

```
SYST:HELP:HEAD?
```
Returns the syntax of all available commands.

Characteristics

*RST value:

SCPI: conform

SYSTem:HELP:SYNTax?

This command returns the full syntax and all parameters of the specified command.

This command is a query and therefore no *RST value.

Parameter

<string> = syntax of command

Example

```
SYST:HELP:SYNT? 'SYST:ERR?'
```
Returns the full syntax. In this case: `'SYSTem:ERRor[:NEXT]'`.

Characteristics
*RST value: -
SCPI: device-specific

SYSTem:LANGuage

This command sets the language of the R&S FSC user interface. You can query a list of available languages with `SYSTem:LANGuage:CATalog?`.

Parameter
<language> = string of the language

Example
`SYST:LANG 'english'`
Sets the system language to English

Characteristics
*RST value: -
SCPI: conform

SYSTem:LANGuage:CATalog?

This command lists all available system languages.

This command is a query and therefore no *RST value.

Example
`SYST:LANG:CAT?`
Characteristics
*RST value: -
SCPI: device-specific

SYSTem:POWer:SOURce?

This command queries whether R&S FSC is battery-powered or line-powered.

This command is a query and therefore has no *RST value.

Return values

ADAP   R&S FSC is powered by the mains adapter.

BATT   R&S FSC is powered by the battery.

Example
`SYST:POW:SOUR?`
Characteristics
*RST value: -
SCPI: conform

SYSTem:POWer:STATus?

This command queries the remaining power of the battery.

This command is a query and therefore has no *RST value.

Return values
0...100 %

Example

SYST:POW:STAT?

Characteristics

*RST value: -
SCPI: conform

SYSTem:PRESet:FACTory

This command initiates an instrument reset back to factory settings.

Example

SYST:PRES:FACT
Resets the R&S FSC to its factory settings.

Characteristics

*RST value: -
SCPI: device-specific

SYSTem:TIME

This command sets the internal clock. The sequence of entry is hour, minute, second.

Parameter

0 to 23, 0 to 59, 0 to 59

Example

SYST:TIME 12,30,30

Characteristics

*RST value: -
SCPI: conform

SYSTem:VERSion?

This command queries the number of the SCPI version, which is relevant for the instrument.

This command is a query and therefore has no *RST value.

Example

SYST:VERS?

Characteristics

*RST value: -
SCPI: conform

5.14   Status Reporting System

The status reporting system (Figure 7) stores all information on the present operating state of the instrument, and on errors which have occurred. This information is stored in the status registers and in the error queue. The status registers and the error queue can be queried via Ethernet.

The information is of a hierarchical structure. The register status byte (STB) defined in IEEE 488.2 and its associated mask register service request enable (SRE) form the uppermost level. The STB receives its information from the standard event status register (ESR) which is also defined in IEEE 488.2 with the associated mask register standard event status enable (ESE) and registers STATus:OPERation and STATus:QUEStionable which are defined by SCPI and contain detailed information on the instrument.

The output buffer contains the messages the instrument returns to the controller. It is not part of the status reporting system but determines the value of the MAV bit in the STB.

5.14.1   Structure of an SCPI Status Register

Each standard SCPI register consists of 5 parts which each have a width of 16 bits and have different functions (Figure 6). The individual bits are independent of each other, i.e. each hardware status is assigned a bit number that applies to all five parts. For example, bit 0 of the STATus:OPERation register is assigned to the calibration status of the R&S FSC. Bit 15 (the most significant bit) is set to zero for all parts. Thus the contents of the register parts can be processed by the controller as positive integer.
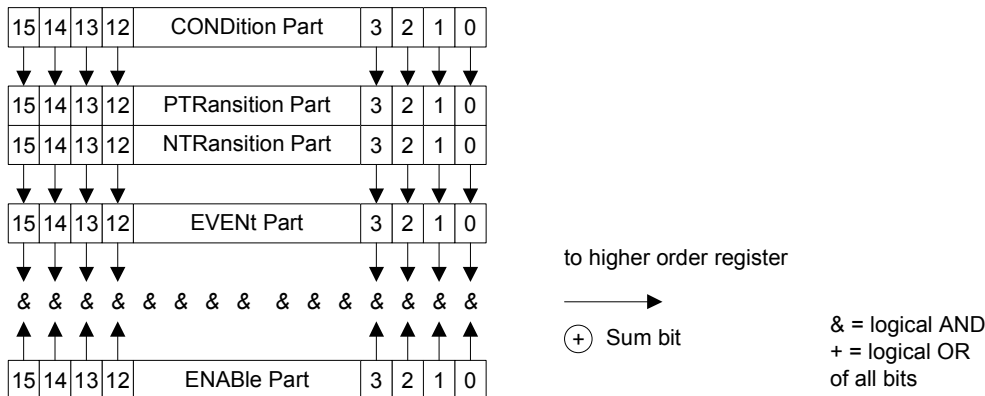
Figure 6: The status-register model

5.14.1.1   CONDition part

The CONDition part is directly written into by the hardware or the sum bit of the next lower register. Its contents reflects the current instrument status. This register part can only be read, but not written into or cleared. Its contents is not affected by reading.

5.14.1.2   PTRansition part

The Positive-TRansition part acts as an edge detector. When a bit of the CONDition part is changed from 0 to 1, the associated PTR bit decides whether the EVENt bit is set to 1.

PTR bit =1: the EVENt bit is set.

PTR bit =0: the EVENt bit is not set.

This part can be written into and read at will. Its contents is not affected by reading.

5.14.1.3 NTRansition part

The Negative-TRansition part also acts as an edge detector. When a bit of the CONDition part is changed from 1 to 0, the associated NTR bit decides whether the EVENt bit is set to 1.

NTR-Bit = 1: the EVENt bit is set.

NTR-Bit = 0: the EVENt bit is not set.

This part can be written into and read at will. Its contents is not affected by reading.

With these two edge register parts the user can define which state transition of the condition part (none, 0 to 1, 1 to 0 or both) is stored in the EVENt part.

5.14.1.4 EVENt part

The EVENt part indicates whether an event has occurred since the last reading, it is the "memory" of the condition part. It only indicates events passed on by the edge filters. It is permanently updated by the instrument. This part can only be read by the user. Reading the register clears it. This part is often equated with the entire register.

5.14.1.5 ENABle part

The ENABle part determines whether the associated EVENt bit contributes to the sum bit (see below). Each bit of the EVENt part is ANDed with the associated ENABle bit (symbol '&'). The results of all logical operations of this part are passed on to the sum bit via an OR function (symbol '+').

ENABle-Bit = 0: the associated EVENt bit does not contribute to the sum bit

ENABle-Bit = 1: if the associated EVENT bit is "1", the sum bit is set to "1" as well.

This part can be written into and read by the user at will. Its contents is not affected by reading.

5.14.1.6 Sum bit

As indicated above, the sum bit is obtained from the EVENt and ENABle part for each register. The result is then entered into a bit of the CONDition part of the higher-order register.

The instrument automatically generates the sum bit for each register. Thus an event, e.g. a PLL that has not locked, can lead to a service request throughout all levels of the hierarchy.

The service request enable register SRE defined in IEEE 488.2 can be taken as ENABle part of the STB if the STB is structured according to SCPI. By analogy, the ESE can be taken as the ENABle part of the ESR.

5.14.2   Overview of the Status Register

The following figure shows the status registers used by the R&S FSC base unit. The status registers used by the R&S FSC options are described in separate sections at the end of this chapter.
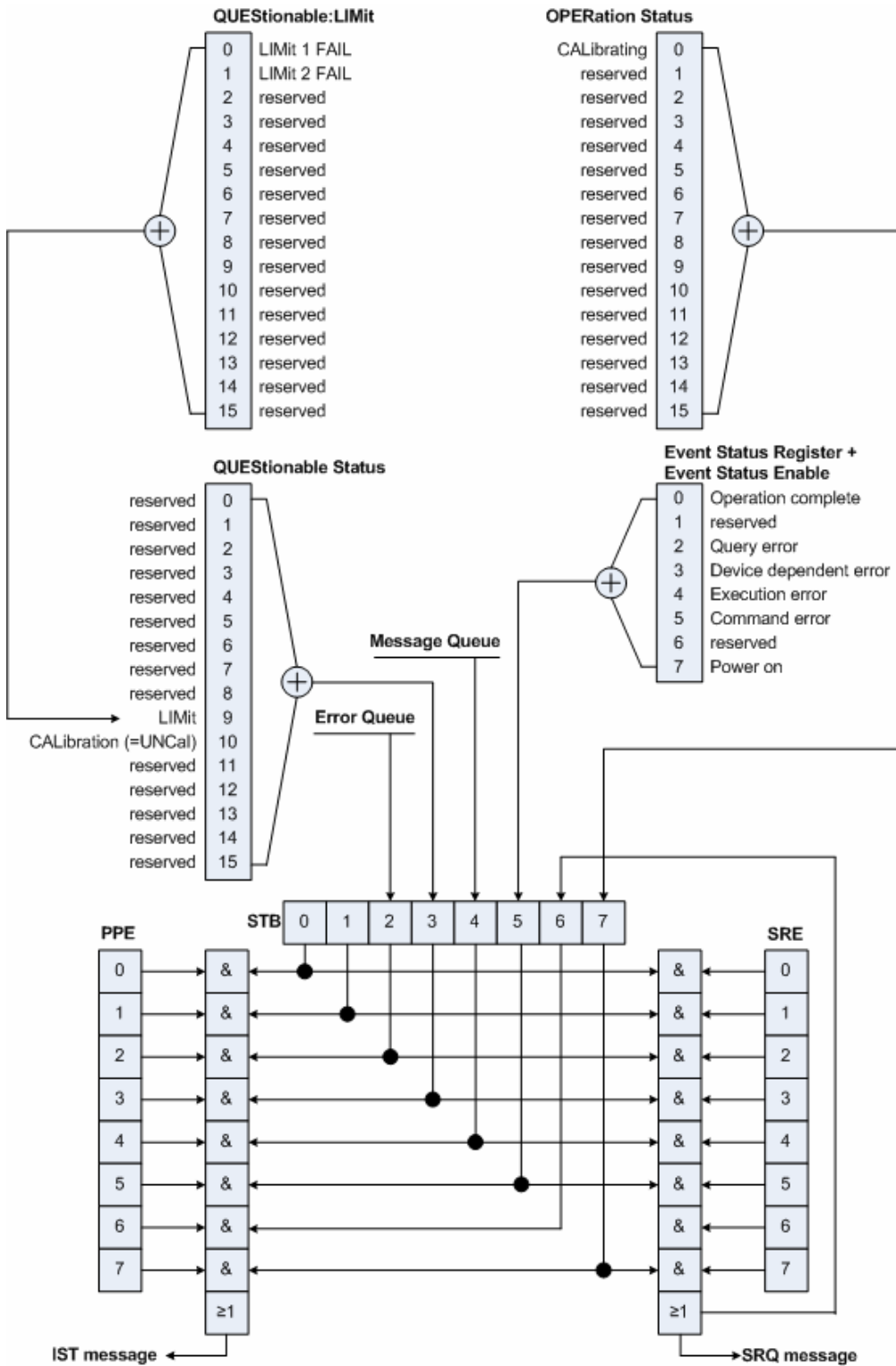
Figure 7: Overview of the status registers

5.14.3 Status Byte (STB) & Service Request Enable Register (SRE)

The STB is already defined in IEEE 488.2. It provides a rough overview of the instrument status by collecting the pieces of information of the lower registers. It can thus be compared with the CONDition part of an SCPI register and assumes the highest level within the SCPI hierarchy. A special feature is that bit 6 acts as the sum bit of the remaining bits of the status byte.

The STATUS BYTE is read using the command "*STB?" or a serial poll.

The STB is linked to the SRE. The latter corresponds to the ENABle part of the SCPI registers in its function. Each bit of the STB is assigned a bit in the SRE. Bit 6 of the SRE is ignored. If a bit is set in the SRE and the associated bit in the STB changes from 0 to 1, a service request (SRQ) is generated, which triggers an interrupt in the controller if this is appropriately configured and can be further processed there. The SRE can be set using the command "*SRE" and read using the command "*SRE?"

Table 3: Meaning of the bits used in the Status Byte

Bit No.	Meaning
0...1	Not used
2	**Error Queue not empty** The bit is set when an entry is made in the error queue. If this bit is enabled by the SRE, each entry of the error queue generates a service request. Thus an error can be recognized and specified in greater detail by polling the error queue. The poll provides an informative error message. This procedure is to be recommended since it considerably reduces the problems involved with remote control.
3	**QUEStionable status sum bit** The bit is set if an EVENt bit is set in the QUEStionable: status register and the associated ENABle bit is set to 1. A set bit indicates a questionable instrument status, which can be specified in greater detail by polling the QUEStionable status register.
4	**MAV bit** (message available) The bit is set if a message is available in the output buffer which can be read. This bit can be used to enable data to be automatically read from the instrument to the controller.
5	**ESB bit** Sum bit of the event status register. It is set if one of the bits in the event status register is set and enabled in the event status enable register. Setting of this bit indicates a serious error which can be specified in greater detail by polling the event status register.
6	**MSS bit** (master status summary bit) The bit is set if the instrument triggers a service request. This is the case if one of the other bits of this registers is set together with its mask bit in the service request enable register SRE.
7	**OPERation status register sum bit** The bit is set if an EVENt bit is set in the OPERation status register and the associated ENABle bit is set to 1. A set bit indicates that the instrument is just performing an action. The type of action can be determined by polling the OPERation status register.

5.14.4   Event Status Register (ESR) and Event Status Enable Register (ESE)

The ESR is defined in IEEE 488.2. It can be compared with the EVENt part of a SCPI register. The event status register can be read out using command *ESR?.

The ESE is the associated ENABle part. It can be set using the command *ESE and read using the command *ESE?.

Table 4: Meaning of the bits in the event status register

Bit No.	Meaning
0	**Operation Complete** This bit is set on receipt of the command *OPC exactly when all previous commands have been executed.
1	Not used
2	**Query Error** This bit is set if either the controller wants to read data from the instrument without having sent a query, or if it does not fetch requested data and sends new instructions to the instrument instead. The cause is often a query which is faulty and hence cannot be executed.
3	**Device-dependent Error** This bit is set if a device-dependent error occurs. An error message with a number between -300 and -399 or a positive error number, which denotes the error in greater detail, is entered into the error queue.
4	**Execution Error** This bit is set if a received command is syntactically correct but cannot be performed for other reasons. An error message with a number between -200 and -300, which denotes the error in greater detail, is entered into the error queue.
5	**Command Error** This bit is set if a command is received, which is undefined or syntactically incorrect. An error message with a number between -100 and -200, which denotes the error in greater detail, is entered into the error queue.
6	Not used
7	**Power On** (supply voltage on) This bit is set on switching on the instrument.

5.14.4.1   STATus:OPERation Register

In the CONDition part, this register contains information on which actions the instrument is being executing or, in the EVENt part, information on which actions the instrument has executed since the last reading. It can be read using the commands STATus:OPERation:CONDition? or STATus:OPERation[:EVENt]?.

Table 5: Meaning of the bits in the STATus:OPERation register

Bit No.	Meaning
0	**CALibrating** This bit is set as long as the instrument is performing a calibration.
1 to 14	Not used
15	This bit is always 0

5.14.4.2   STATus:QUEStionable Register

This register contains information about indefinite states which may occur if the unit is operated without meeting the specifications. It can be read using the commands STATus:QUEStionable: CONDition? and STATus:QUEStionable[:EVENt]?.

Table 6: Meaning of bits in STATus:QUEStionable register

Bit No.	Meaning
0 to 8	Not used
9	**LIMit** (device-specific) This bit is set if a limit value is violated
10	**CALibration** The bit is set if a measurement is performed unaligned (label **UNCAL**)
11 to 14	Not used
15	This bit is always 0.

5.14.4.3 STATus:QUEStionable:LIMit Register

This register contains information about the observance of limit lines. It can be read using the commands STATus:QUEStionable:LIMit:CONDition? and STATus:QUEStionable:LIMit[:EVENt]?.

Table 7: Meaning of bits in STATus:QUEStionable:LIMit register

Bit No.	Meaning
0	**LIMit 1 FAIL** This bit is set if limit line 1 is violated.
1	**LIMit 2 FAIL** This bit is set if limit line 2 is violated.
2 to 14	Not used
15	This bit is always 0.

5.14.5 Application of the Status Reporting Systems

In order to be able to effectively use the status reporting system, the information contained there must be transmitted to the controller and further processed there. There are several methods which are represented in the following.

5.14.5.1 Service Request

Under certain circumstances, the instrument can send a service request (SRQ) to the controller. Usually this service request initiates an interrupt at the controller, to which the control program can react appropriately. As evident from Fig. 1-4, an SRQ is always initiated if one or several of bits 2, 3, 4, 5 or 7 of the status byte are set and enabled in the SRE. Each of these bits combines the information of a further register, the error queue or the output buffer. The ENABle parts of the status registers can be set so that arbitrary bits in an arbitrary status register initiate an SRQ. In order to make use of the possibilities of the service request effectively, all bits should be set to "1" in enable registers SRE and ESE.

> *Example*
> Use of the command *OPC to generate an SRQ at the end of a sweep

```
CALL InstrWrite(analyzer, "*ESE 1")
```
> 'Set bit 0 in the ESE (Operation Complete)
```
CALL InstrWrite(analyzer, "*SRE 32")
```
> 'Set bit 5 in the SRE (ESB)?
> After its settings have been completed, the instrument generates an SRQ.

The SRQ is the only possibility for the instrument to become active on its own. Each controller program should set the instrument in a way that a service request is initiated in the case of malfunction. The program should react appropriately to the service request.

5.14.5.2   Serial Poll

In a serial poll, just as with command *STB, the status byte of an instrument is queried. However, the query is realized via interface messages and is thus clearly faster. The serial-poll method has already been defined in IEEE 488.1 and used to be the only standard possibility for different instruments to poll the status byte. The method also works with instruments which do not adhere to SCPI or IEEE 488.2.

The VISUAL BASIC command for executing a serial poll is IBRSP(). Serial poll is mainly used to obtain a fast overview of the state of several instruments connected to the controller.

5.14.5.3   Query by Means of Commands

Each part of any status register can be read by means of queries. The individual commands are listed in the description of the STATus Subsystem. The returned value is always a number that represents the bit pattern of the queried register. This number is evaluated by the controller program.

Queries are usually used after an SRQ in order to obtain more detailed information on the cause of the SRQ.

5.14.5.4   Error Queue Query

Each error state in the instrument leads to an entry in the error queue. The entries of the error queue are detailed plain-text error messages that can be displayed via manual operation using the setup menu or queried via remote control using the command SYSTem:ERRor?. Each call of SYSTem:ERRor? provides one entry from the error queue. If no error messages are stored there any more, the instrument responds with 0, "No error".

The error queue should be queried after every SRQ in the controller program as the entries describe the cause of an error more precisely than the status registers. Especially in the test phase of a controller program the error queue should be queried regularly since faulty commands from the controller to the instrument are recorded there as well.

5.14.6 Reset Values of the Status Reporting System

Table 8 contains the different commands and events causing the status reporting system to be reset. None of the commands, except *RST and SYSTem:PRESet, influences the functional instrument settings. In particular, DCL does not change the instrument settings.

Table 8: Resetting the status reporting system

Event	Switching on supply voltage		DCL,SDC	*RST or SYSTem:PRESet	STATus:PRESet	*CLS
	Power-On-Status-Clear		(Device Clear, Selected Device Clear)			
Effect	**0**	**1**				
Clear STB,ESR	—	yes	—	—	—	yes
Clear SRE,ESE	—	yes	—	—	—	—
Clear PPE	—	yes	—	—	—	—
Clear EVENt parts of the registers	—	yes	—	—	—	yes
Clear ENABle parts of all OPERation and QUEStionable registers; Fill ENABle parts of all other registers with "1".	—	yes	—	—	yes	—
Fill PTRansition parts with "1"; Clear NTRansition parts	—	yes	—	—	yes	—
Clear error queue	yes	yes	—	—	—	yes
Clear output buffer	yes	yes	yes	1)	1)	1)
Clear command processing and input buffer	yes	yes	yes	—	—	—

1) Every command being the first in a program message, i.e., immediately following a <PROGRAM MESSAGE TERMINATOR> clears the output buffer.

5.15   Remote Commands of the Status Reporting System

The following commands control the status-reporting system. *RST does not influence the status registers.

The OPERation status register contains information about the calibration status of the instrument.

The QUEStionable status register contains information about the status of the reference and local oscillator, possible overloads of the instrument and the status of limit checks and limit margins.

The commands are independent from the operating mode.

List of commands

STATus:PRESet

This command resets the edge detectors and ENABle parts of all registers to a defined value. All PTRansition parts are set to FFFFh, i.e. all transitions from 0 to 1 are detected. All NTRansition parts are set to 0, i.e. a transition from 1 to 0 in a CONDition bit is not detected. The ENABle part of the STATus:OPERation and STATus:QUEStionable registers are set to 0, i.e. all events in these registers are not passed on.

Example
`STAT:PRES`
Characteristics
*RST value: -

SCPI: conform

STATus:QUEue[:NEXT]

This command returns the earliest entry to the error queue and deletes it.

Positive error numbers indicate device-specific errors, negative error numbers are error messages defined by SCPI. If the error queue is empty, the error number 0, "no error", is returned. This command is identical with the command SYSTem:ERROr.

Example

STAT:QUE?

Characteristics

*RST value: –

SCPI: conform

STATus:OPERation[:EVENt]?

This command queries the contents of the EVENt section of the STATus:OPERation register.

The contents of the EVENt section are deleted after readout.

Example

STAT:OPER?

Characteristics

*RST value: -

SCPI: conform

STATus:OPERation:CONDition?

This command queries the CONDition section of the STATus:OPERation register. Readout does not delete the contents of the CONDition section. The value returned reflects the current hardware status.

Example

STAT:OPER:COND?

Characteristics

*RST value: -

SCPI: conform

STATus:OPERation:ENABle

This command sets the bits of the ENABle section of the STATus:OPERation register. The ENABle register selectively enables the individual events of the associated EVENt section for the summary bit in the status byte.

Parameter

0 to 65535

Example

STAT:OPER:ENAB 65535

Characteristics

*RST value: -

SCPI: conform

STATus:OPERation:NTRansition

This command sets the edge detectors of all bits of the STATus:OPERation register from 1 to 0 for the transitions of the CONDition bit.

Parameter

0 to 65535

Example

STAT:OPER:NTR 65535

Characteristics

*RST value: -

SCPI: conform

STATus:OPERation:PTRansition

This command sets the edge detectors of all bits of the STATus:OPERation register from 0 to 1 for the transitions of the CONDition bit.

Parameter

0 to 65535

Example

STAT:OPER:PTR 65535

Characteristics

*RST value: -

SCPI: conform

STATus:QUEStionable[:EVENt]?

This command queries the contents of the EVENt section of the STATus:QUEStionable register.

The contents of the EVENt section are deleted after readout.

Example

STAT:QUES?

Characteristics

*RST value: -

SCPI: conform

STATus:QUEStionable:CONDition?

This command queries the CONDition section of the STATus:QUEStionable register. Readout does not delete the contents of the CONDition section. The value returned reflects the current hardware status.

Example

STAT:QUES:COND?

Characteristics

*RST value: -

SCPI: conform

STATus:QUEStionable:ENABle

This command sets the bits of the ENABle section of the STATus:QUEStionable register. The ENABle register selectively enables the individual events of the associated EVENt section for the summary bit in the status byte.

Parameter

0 to 65535

Example

STAT:QUES:ENAB 65535

Characteristics

*RST value: -

SCPI: conform

STATus:QUEStionable:NTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable register from 1 to 0 for the transitions of the CONDition bit.

Parameter

0 to 65535

Example

STAT:QUES:NTR 65535

Characteristics

*RST value: -

SCPI: conform

STATus:QUEStionable:PTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable register from 0 to 1 for the transitions of the CONDition bit.

Parameter

0 to 65535

Example

STAT:OPER:PTR 65535

Characteristics

*RST value: -

SCPI: conform

Alphabetical List of Remote Commands

CALibration Commands

DISPlay Commands

FETCh Commands

FORMat Commands

HCOPy Commands

SOURce Commands

STATus Commands

SYSTem Commands

TRACe Commands

TRIGger Commands

UNIT Commands

Index